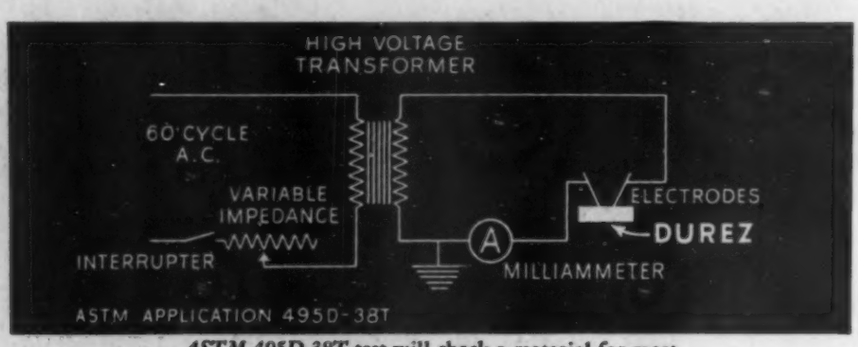
MODERN PLASTICS

FEBRUARY 1943

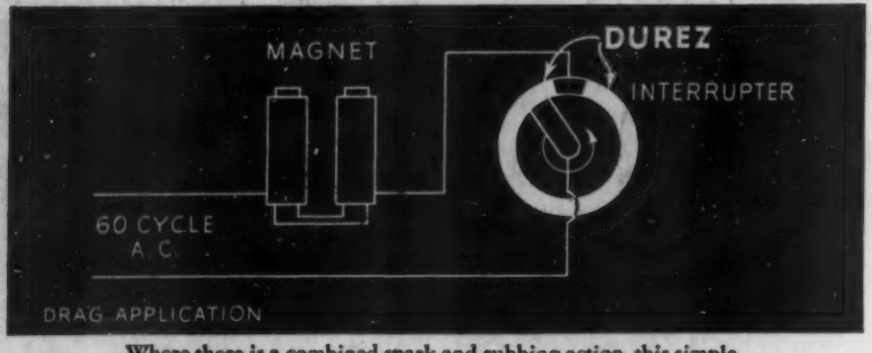
BLUE PRINT FOR YOUR ARC RESISTANCE REQUIREMENTS

WHICH OF THESE TEST METHODS corresponds to your service conditions when plastic parts specifications call for arc resistance? Durez laboratory research combined with practical field applications reveals that several types of specially formulated plastics are required for the conditions set up in the tests shown here. No one material is completely satisfactory for all three.

IF this test approximates your service conditions, you will then want to specify Durez 8685 Natural or Durez 12122 Natural. Both show excellent resistance before tracking. Should large metal inserts be required in the part, then Durez 8685 will serve better because it has greater flexibility to compensate for thermal expansion of the metal and will not crack when the part is subjected to continual temperature changes.



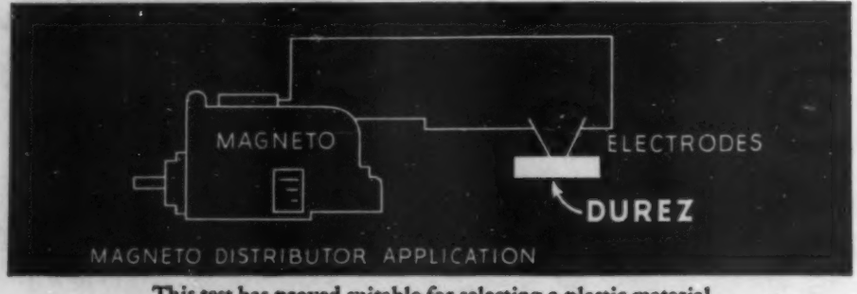
ASTM 495D-38T test will check a material for most arc-resistant applications.



Where there is a combined spark and rubbing action, this simple drag test gives an excellent check.

FOR this condition Durez 8685 has a very high rating. After prolonged testing, no evidence of tracking on the Durez plastic part could be found.

TO meet service conditions of this type, still other Durez molding compounds had to be developed. Durez 11380 Black or Durez 11610 Black stands up indefinitely for such applications. Other factors determine which material will serve more suitably.



This test has proved suitable for selecting a plastic material for use in a magneto distributor application.

IN addition to these tests, you doubtless have others of your own for special conditions. We would be glad to submit samples of molded Durez for such tests in your own laboratory. Please include a brief explanation of your requirements. Just write to . . . Durez Plastics & Chemicals, Inc., 222 Walck Rd., North Tonawanda, N. Y.

DUREZ

PLASTICS THAT FIT THE JOB

0,000,000

water absorption

The degree to which a substance will absorb water is important not only in its own right but because of the intimate relationship it bears to many other physical properties.

Ratings of electrical characteristics, mechanical strengths, chemical resistance and dimensional stability may be meaningless unless the factor of water absorption is taken into consideration.

It's not enough for a plastic *material* to have certain desired qualities—those same properties must be maintained in the finished fabricated or molded *product* in actual use under field conditions and over a specified period of time.

That's why when we tell you that "Loalin", our polystyrene molding compound, has a Water-Absorption of 0.00% (24 hrs.) you know that parts or products built of this material are nowhere surpassed and rarely equalled in this vital respect. The Water-Absorption of "Catalin", our cast phenolic resin, ranges from only 0.1% ("Chemical-Resistant Resin") to 3.0%, depending on the base formula.

There's no mystery to selecting the best plastic for any specific purpose. All it requires is a thorough and *first-hand* knowledge of the physical properties and workability of each type under consideration. Our engineers and chemists have that knowledge . . . and the years of experience gained in working with designers and manufacturers in every industry.

Their invaluable services are at your disposal—whether for immediate wartime needs or for foresighted peacetime planning. Your inquiry will receive prompt and expert attention.

Cast Resins
Molding Compounds
Liquid Resins

CATALIN
CORPORATION

ONE PARK AVENUE • NEW YORK, N. Y.

ONE · OF · A · SERIES · ON · THE · PHYSICAL · PROPERTIES · OF · PLASTIC · MATERIALS

modern plastics

INCLUDING Plastics ENGINEERING

VOLUME 20 FEBRUARY 1943 NUMBER 6

GENERAL INTEREST

PLASTICS ENGINEERINC

TECHNICAL SECTION

NEWS AND FEATURES

EXECUTIVE and EDITORIAL OFFICES: 122 E. 42nd St., New York, N. Y. WASHINGTON, D. C. OFFICE: National Press Building

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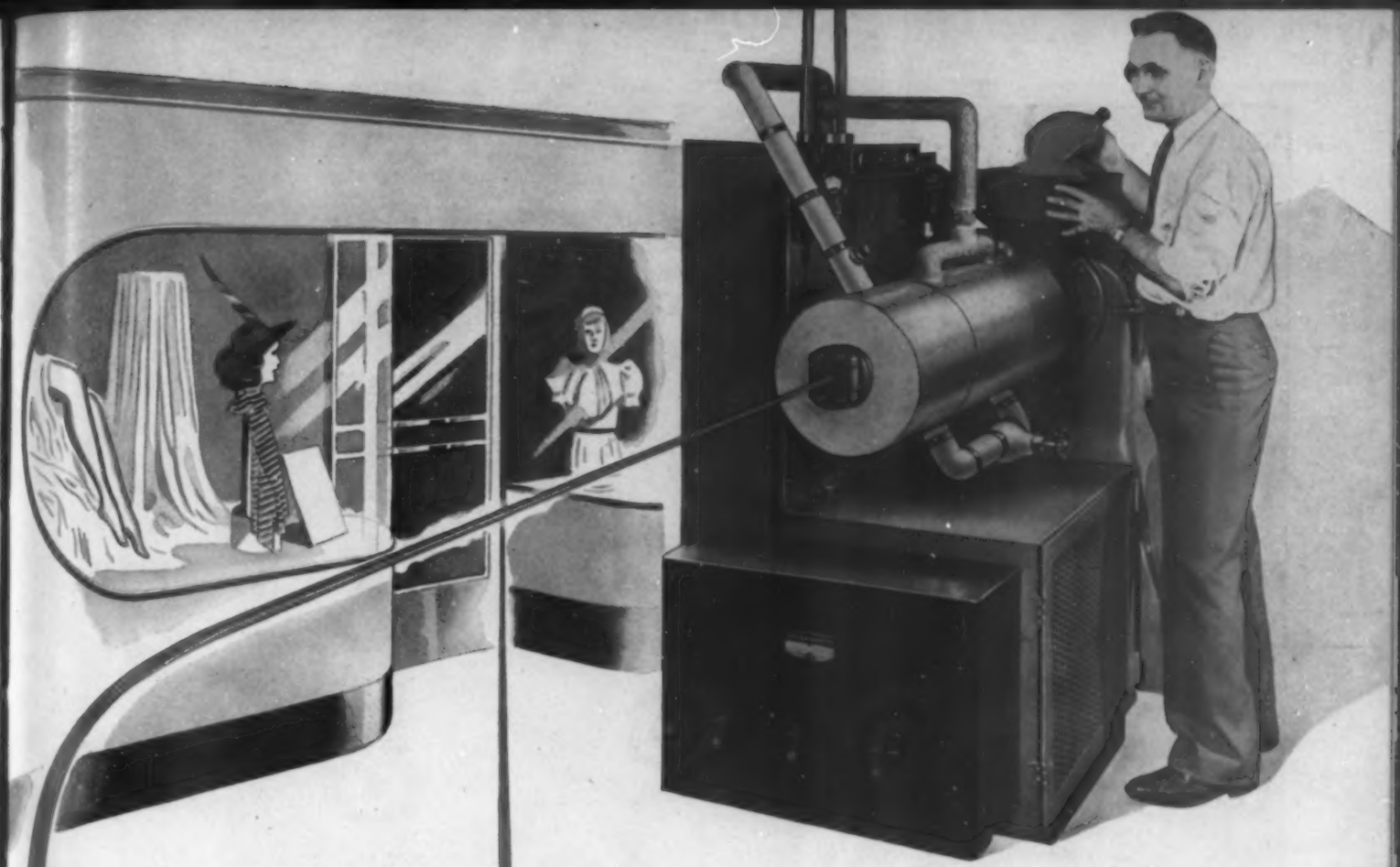


MACHINES THAT CAN "Lift the face" OF A BUILDING!

MODERN architecture has used plastics in many ways. They add color, life and design. They are durable, washable and easy to install. They can actually "lift the face" of a building.

This plastics extruding machine was built to turn out cellulose acetate profiles for modern store fronts (today it is being used for war production). The process was economical—the design rolled out in continuous lengths onto a 40-foot conveyor belt, blower and cooling ducts providing proper cooling for the extruded material.

When such peacetime products can again be sold, extruded profiles for private homes, office equipment, and other architectural uses may well become the accepted practice.

To the manufacturer who might use Plastics Extruders—but hasn't

No one standard plastics extruding machine can successfully process every plastic. Different conditions are encountered with different plastics, changes in design and operation are necessary. Machines should be designed for specific jobs to achieve economical, trouble-free operation.

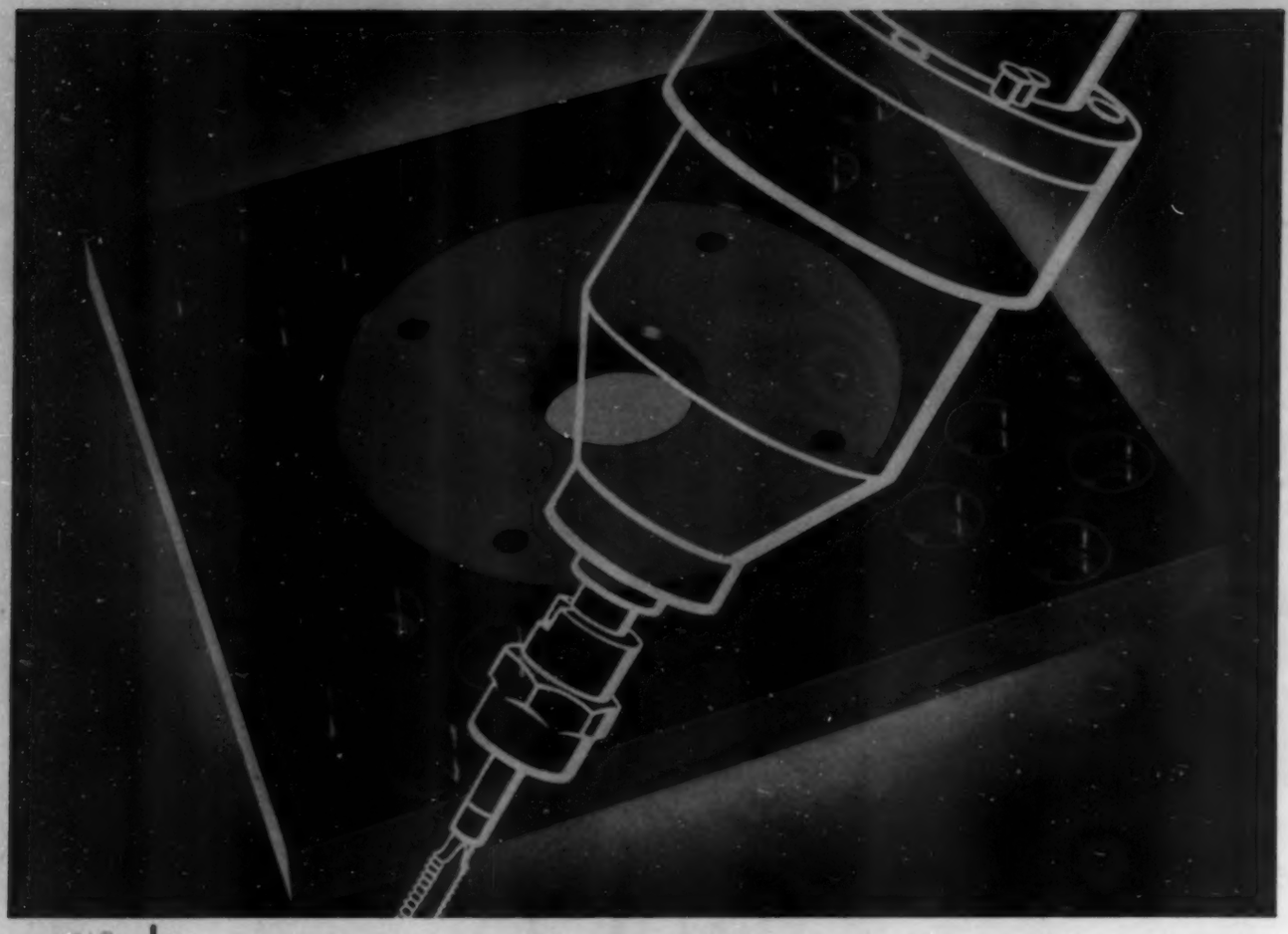
The Plastics Division of National Rubber Machinery Company has designed and built more plastics extruders than all other makers combined. These include machines for practically every thermoplastic yet developed, and the successful operation of each machine has been assured by the policy of *building* for the specific job involved, and proving it by trial production runs in National's modern Pilot Plant. The facilities of this plant are always available to help you solve production problems.

The great potentialities of the extrusion process point to a broader, extremely profitable use in the future. Why not let a National engineer discuss the possibilities in your business?

Plastics Division

NATIONAL RUBBER MACHINERY COMPANY

General Offices: Akron, Ohio



Drilling For Military Service

Made Easy for Rookies

"ROOKIES" in the machine shop now have to produce parts and finished products faster and in greater quantities than used to be expected from veterans.

That's another reason why INSUROK has won such wide approval among war products manufacturers. No special machinery or unusual skill is required for the fabrication of INSUROK. In drilling, for example, just use standard twist drills. Where quantity production is required, Tungsten-carbide tipped drills are recommended, if available.

If you have a fabrication problem, *Richardson Plasticians* will be glad to suggest efficient methods of production. Just send in your designs for their recommendations. If you do not have data covering the various grades of Laminated or Molded INSUROK, write for them.

The Richardson Company, Melrose Park, Illinois; Lockland, Ohio; New Brunswick, New Jersey; Indianapolis, Indiana. Sales Offices: 75 West Street, New York City; G. M. Building, Detroit.

INSUROK *and the experience of Richardson Plasticians are helping war products producers by:*

1. Increasing output per machine-hour.
2. Shortening time from blueprint to production.
3. Facilitating sub-contracting.
4. Saving other critical materials for other important jobs.
5. Providing greater latitude for designers.
6. Doing things that "can't be done."
7. Aiding in improved machine and product performance.

INSUROK

MADE AND SOLD ONLY BY THE RICHARDSON COMPANY

NEW MANUAL

for fabricators of "Lucite," to aid in the war production effort

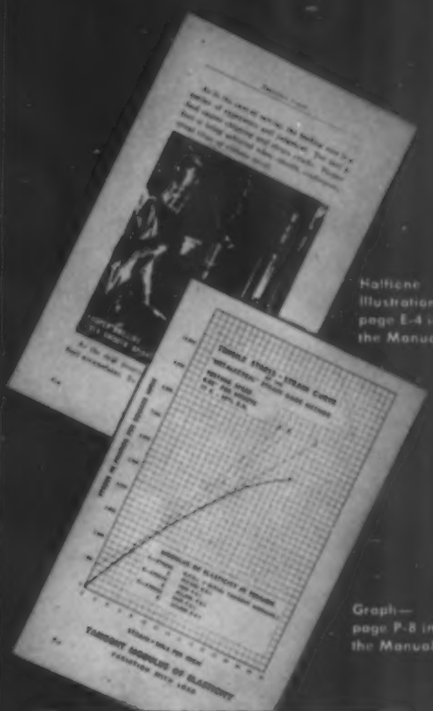
60 INFORMATIVE ILLUSTRATIONS
38 Halftones and Drawings
7 Charts, 9 Graphs, 6 Diagrams
Handbook Size—5" x 7¾", for easy handling, reading and pocketing

114 PAGES OF FACTS

HOW TO FABRICATE and form crystal-clear Du Pont "Lucite" methyl methacrylate resin sheeting.

DU PONT'S new, authoritative Manual on "Lucite" is the result of thousands of actual fabrications and tests made by Du Pont and industrial users of "Lucite." This Manual clearly describes working methods which have given highly satisfactory results in the application of "Lucite." Besides explaining equipment and procedure for each fabricating step, the Manual gives extensive data on the plastic's chemical composition . . . forms, sizes and shapes . . . general manufacturing helps. Plus—38 pages on mechanical, thermal and miscellaneous properties to aid designers and engineers.

For your *free* copy, clip the coupon below, or write Du Pont on your business letterhead.



SPECIFIC DATA COVERED BY THE MANUAL

How to Saw	How to Scrape
How to Blank & Punch	How to Finish
	How to Clean
How to Drill	How to Cement
How to Thread & Tap	How to Form
	How to Mount & Install
How to Rout & Shape	How to Repair
How to Sand	Physical Properties

DU PONT

PLASTICS

BETTER THINGS FOR BETTER LIVING... *THROUGH CHEMISTRY*

E. I. du Pont de Nemours & Co. (Inc.)
Plastics Department—P. Arlington, N. J.

Gentlemen: Please send a copy of your new Manual on "Lucite" for aircraft.

Name_____ Title_____

Address_____

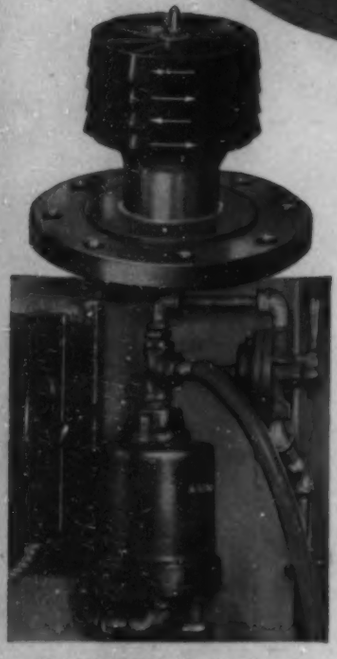
City_____ State_____

(Be sure to attach to your business letterhead.)

A CASE HISTORY
from the Chicago Molded Products Corporation files...and a Good Reason for Checking Plastics Applications

HOW MOLDED PLASTICS DO A *Better* JOB

FOR LOGAN ENGINEERING COMPANY



Molded Plastics for Aluminum!

Large Photo at Top — Logan's new phenolic rotor.

Center — Rotor assembly. Alternate rotors turn in opposite directions.

Below — Typical Aridifier installation . . . in air line to paint spray booth.

THE PROBLEM: The Logan Aridifier is a device for removing condensed moisture, oil, and dirt from compressed air and gas lines. It consists of a rugged housing in which four vaned rotors are mounted in the airstream, clarifying it by impact and centrifugal force. These rotors *were* made of cast aluminum. Could another satisfactory material be found?

THE SOLUTION: Compression molded plastic rotors, of moisture resistant medium — impact phenolic material . . . molded by Chicago Molded Products Corporation.

***THE RESULTS:** **A.** The molded plastic rotor, being uniform in density, eliminates tedious, costly, individual balancing operations. *(Costs! Maintenance of Production Rates!)*

B. 58% of the grinding, machining and finishing operations formerly required are eliminated — and effectiveness of rotors is improved! *(Costs! Man and Machine Hours!)*

C. Weight of each rotor is reduced one-fifth, lessening back pressure in line proportionally. *(Improvement of Product!)*

D. Logan is getting delivery. (!!!)

Manufacturers interested in checking molded plastics applications are invited to make full use of our engineering department. Our service includes design, engineering, mold-making, fabrication and finishing. And whether you're working on an A-1-A war production problem, or long range post-war product development, Chicago Molded Products Corporation service will give you better results. Write us!

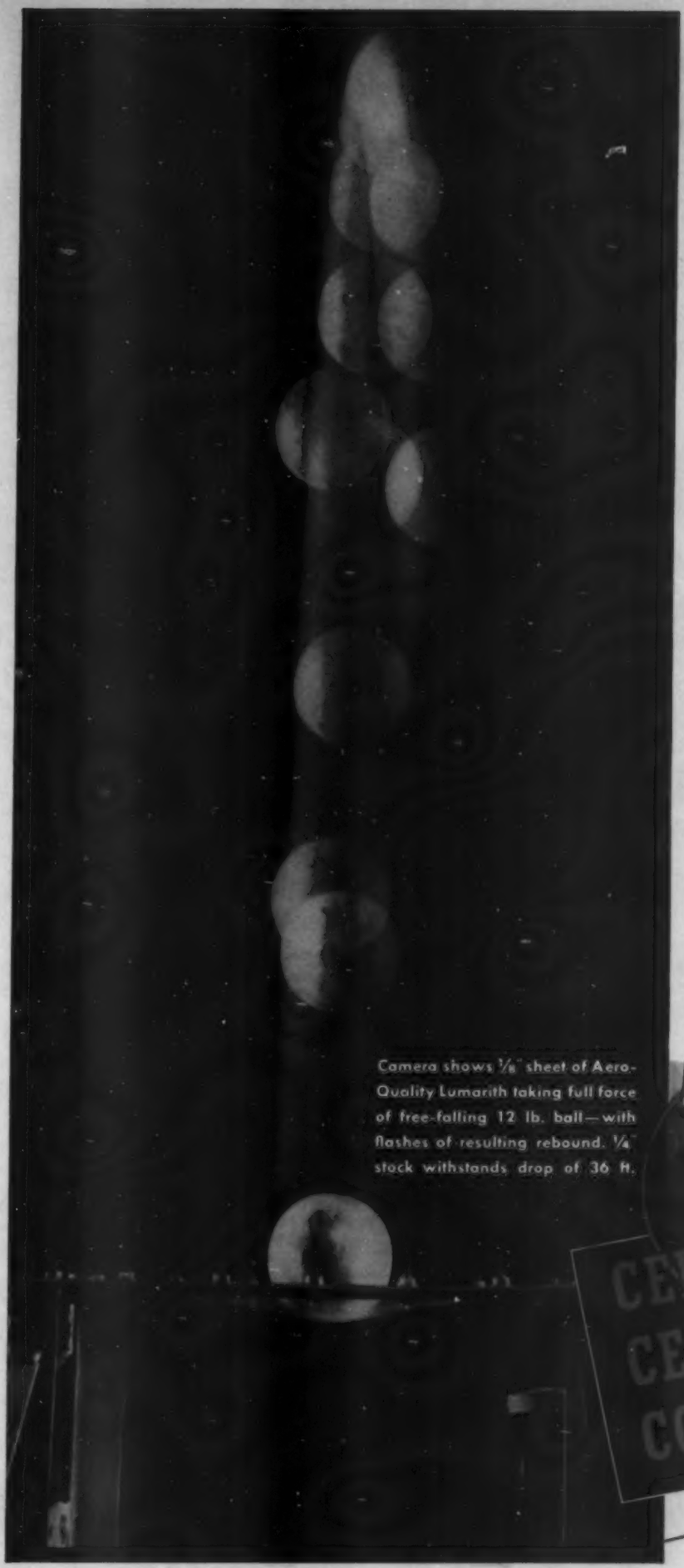
CHICAGO MOLDED PROD. CORP.

CHICAGO MOLDED PRODUCTS CORPORATION

Precision Plastic Molding

1046 North Kolmar Ave., Chicago, Illinois

COMPRESSION, INJECTION AND TRANSFER MOLDING OF ALL PLASTIC MATERIALS



Camera shows ⅛" sheet of Aero-Quality Lumarith taking full force of free-falling 12 lb. ball—with flashes of resulting rebound. ¼" stock withstands drop of 36 ft.

Checking IMPACT STRENGTH of Aero-Quality LUMARITH plastics for U. S. Aircraft

The outstanding impact strength of Aero-Quality Lumarith plastics is made visible to the human eye by the Gjon Mili repetitive flash photograph. The 12-lb. iron ball (4½" in diameter) is dropped from a height of 10 feet on ⅛" thick sheet of transparent Aero-Quality Lumarith plastic. The 12-lb. ball is shown hitting the Lumarith and bouncing in the air, leaving the sheet intact.

Transparent Lumarith sheets are cold-formed or heat-formed to make the windows of cockpits and turrets for many United Nations planes and gliders. Aero-Quality Lumarith protects flyers against severe sunburn.

• • •

Celanese Celluloid Corporation, 180 Madison Ave., New York City, a division of Celanese Corporation of America. *Representatives: Dayton, Cleveland, Chicago, St. Louis, Detroit, San Francisco, Los Angeles, Washington, D. C., Leominster, Montreal, Toronto, Ottawa.*

CELANESE CELLULOID CORPORATION

The first name in plastics

A division of
Celanese Corporation of America

A BETTERMENT . . .

Not a Substitute

The modern dictating machine is not a substitute for the handwritten "copying ink" letter of the last century.

It is a BETTERMENT.

What executive could afford to go back to handwriting his own letters? His competitors would soon outstrip him if he even dared try it.

Neither will forward-looking designers and engineers want to go back to habitually used, now hard-to-get, weighty, corrosive, costly materials. These men are discovering that CONTINENTAL-DIAMOND NON-metallics offer unique property combinations that make possible betterment of product, process and performance.

They have made such discoveries by bringing their "What Material?" problems to the C-D Research Laboratory. With FIVE C-D NON-metallic materials to use . . . with over 27 years of "know how" to draw upon . . . and free from any prejudice favoring one or two types of NON-metallics, the C-D Laboratory is usually able to work out an answer to most problems that definitely results in a BETTERMENT.

You can get acquainted with C-D NON-metallics through our Booklet GF-6. When you want Laboratory Research assistance . . . it's yours for the asking.

Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

Now available

"Plexiglas"

a motion picture... with sound

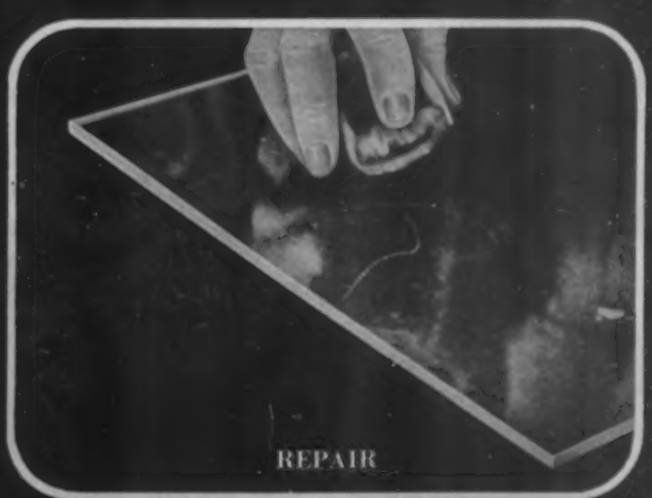
WITHOUT injecting sales talk, the Rohm & Haas Company has produced a sound film on the maintenance and repair of PLEXIGLAS.

It's a factual, semi-technical film designed to facilitate the use of PLEXIGLAS in war production. It already has been shown in more than 150 Army Air Force bases as an aid to ground crew instruction.

The opportunity is offered to the aircraft industry and to educational institutions to borrow a print of this interesting 16 mm. sound film. Using your letterhead, write Rohm & Haas Company, Washington Square, Philadelphia, Pa., giving your first and second choice of dates and the approximate length of time you expect to use it.

FABRICATION

MAINTENANCE



REPAIR

PLEXIGLAS is a trade-mark, Reg. U. S. Pat. Off., for an acrylic resin thermoplastic manufactured by the Rohm & Haas Company.

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA, PA.

Manufacturers of Leather and Textile Specialties and Finishes... Enzymes... Crystal-Clear Acrylic Plastics... Synthetic Insecticides... Fungicides... and other Industrial Chemicals

Cut Recruit Training Period of Your Screw Driver Army

ANYONE CAN DRIVE PHILLIPS SCREWS!

In many of today's war-expanded plants, *raw recruits* now literally walk from the employment office into responsible screw-driving jobs previously rated as skilled work. They produce efficiently, too, because the job is simplified and made foolproof by Phillips recessed head Screws.

The Phillips driver centers *automatically* in the recess . . . can't slip out to injure hands or spoil the work. This means centered *driving force* . . . no fumbling, wobbly starts . . . no slant-driven screws . . . no burred or broken screw heads.

Snug fit and perfect centering of driver in the Phillips Recess enable workers to make *uniformly tight* fastenings . . . and do it with *less effort.* Driving speed is often *doubled* because easy-driving, skid-proof Phillips recessed head Screws make power-driving practical!

They cost less to use! Compare the cost of driving Phillips and slotted head screws. You'll find that the price of screws is a minor item in your total fastening expense . . . that it actually costs less to have the many advantages of the Phillips Recess!

KEY TO FASTENING SPEED AND ECONOMY

The Phillips Recessed Head was scientifically engineered to afford:

Fast Starting – Driver point automatically centers in the recess . . . fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.

Faster Driving – Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

Easier Driving – Turning power is fully utilized by automatic centering of driver in screw head. Workers maintain speed without tiring.

Better Fastenings – Screws are set-up uniformly tight, without burring or breaking heads. A stronger, neater job results.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

21 SOURCES

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Reading Screw Co., Norristown, Pa.
Pheoll Manufacturing Co., Chicago, Ill.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

Just now our minds are overseas with our fighting men. Nothing counts except to provide them with the best tools for their jobs. Nixon . . . like other vital war plants . . . is devoting its resources to producing war materials.

Victory will find America with well-equipped factories but with homes needing almost everything from automobiles to new bathrooms. Look homeward, engineers . . . for your post-war markets. Perhaps we can assist you in adapting a Nixon Plastic to your design and production requirements.

Nixon offers Cellulose Acetate and Cellulose Nitrate SHEETS to fit precision measurements, capable of being formed to compound curves . . . an Ethyl Cellulose sheeting which replaces natural rubber under some conditions . . . RODS, TUBES, and EXTRUDED PROFILES in continuous lengths . . . Cellulose Acetate and Ethyl Cellulose MOLDING POWDERS which are clean and uniform in color and formation. Nixon Plastics will play a major role in the coming plastics age.

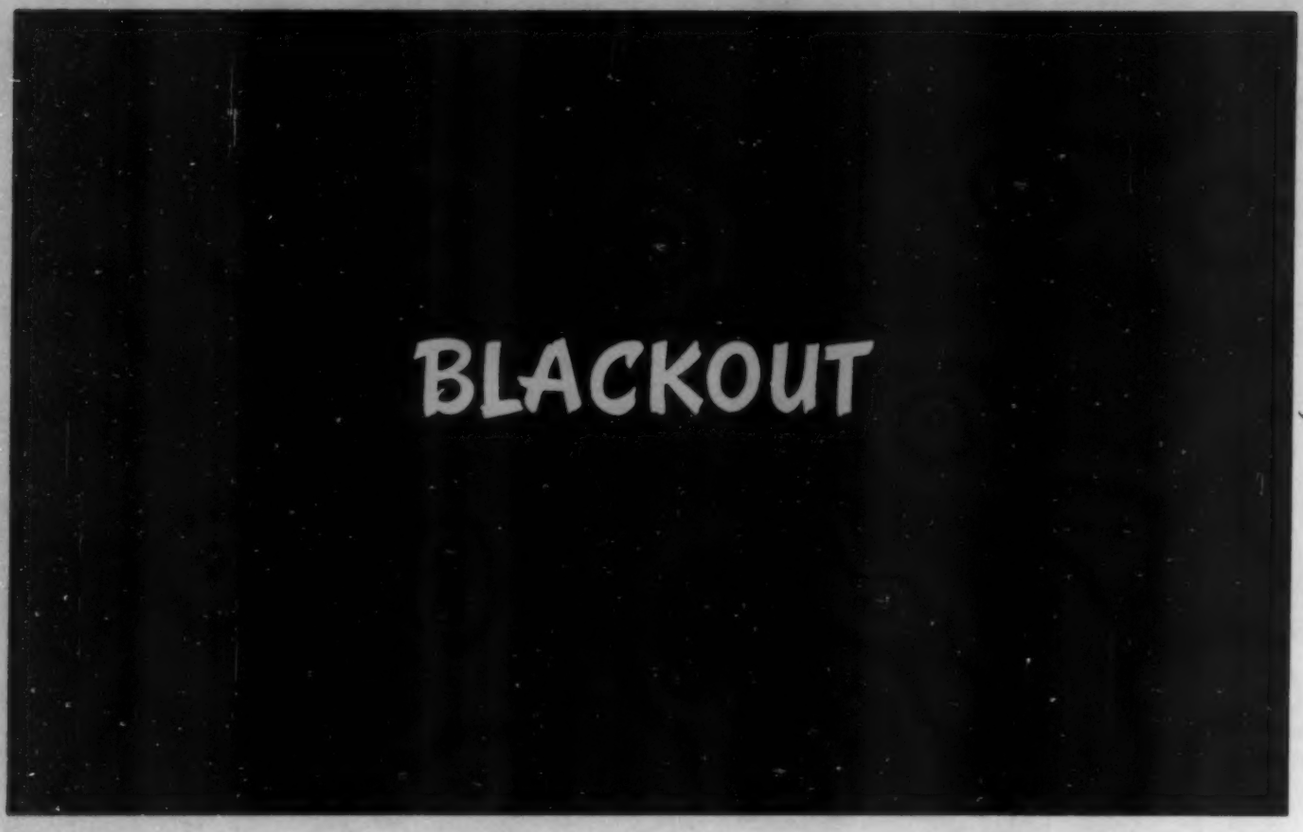
NIXON *Plastics*

NIXON NITRATION WORKS, INC.

NIXON, NEW JERSEY

Mfrs: NIXON ACETATE MOLDING POWDERS • NIXONITE (acetate) and NIXONOID (nitrate), sheets, rods, tubes

H. J. FAHRINGER, 1219 No. Austin Blvd., Chicago, Ill. *Esterbrook 4242* • C. D. KERR, Jr., Washington Hotel, Washington, D. C.
T. C. McKENZIE, 618 Fisher Bldg., Detroit, Mich. *Madison 4400* • CHANTLER & CHANTLER, LTD., Toronto, Ont., Canada *Elgin 5215*
W. S. MOWRY, 126 Marsdon St., Springfield, Mass. *Springfield 4-7121* • A. F. PERRY, Leominster, Mass. *Leominster 1011*
C. B. JUDD, 401 Loudermann Bldg., St. Louis, Mo. *Chestnut 8495*



This is a group of gadgets and trinkets we have been making recently for a group of busy customers. Crazy looking things, we haven't the slightest idea what they are used for, vending machines of some sort, perhaps automatic stop lights.

We took the picture with infra red rays in a blackout, but something didn't work right. The result might have been expected. After all, we are molders and not photographers. Perhaps we are not even quite bright outside of the molding line.

Anyway, if you could see the things we are making now you certainly would have plenty of ideas for the sunny days that are coming, after the blackouts and dimouts.

You'll be scratching for business, too, and plastics will mean a lot to you—so just file our name away under "Future Business."

We can't invite you to visit us now. But when we can resume our normal practice of open house, you'll see a factory layout you can have complete confidence in and meet an organization that knows its stuff from top to bottom.

"A Ready Reference for Plastics" written for the layman, is now in a new edition. If you are a user or a potential user of molded plastics, write us on your letterhead for a copy of this plain non-technical explanation of their uses and characteristics. Free to business firms and government services.

BMCB

ARMY E NAVY

BOONTON MOLDING COMPANY

MOLDERS OF PLASTICS : PHENOLICS · UREAS · THERMO PLASTICS

BOONTON · NEW JERSEY · Tel. Boonton 8-2020

N. Y. Office—Chanin Bldg., 122 East 42nd Street, Murray Hill 6-8540

THESE PRODUCTS

Never saw a Rubber tree

PLASTICS are replacing vital rubber as well as saving scarce metals. Here is another accomplishment in Auto-Lite's long record in developing and applying plastics to a wide variety of rubber and metal products. Frequently production is simplified, designs are improved and often costs are lowered substantially. Our experience in both compression and injection moulding is freely available to manufacturers who believe plastics might be the solution to their production problems. You may find plastics not just an *out*—but an advance, for the duration . . . and after.

THE ELECTRIC AUTO-LITE COMPANY
Bay Manufacturing Division
BAY CITY • MICHIGAN

Specify
AUTO-LITE
PLASTICS
FOR THE DURATION . . . AND AFTER

HARD CHROMIUM PLATING

Available for MOLD CONSERVATION

So far, the amount of chromium available for application on mold surfaces and machine tool parts, has not been curtailed.

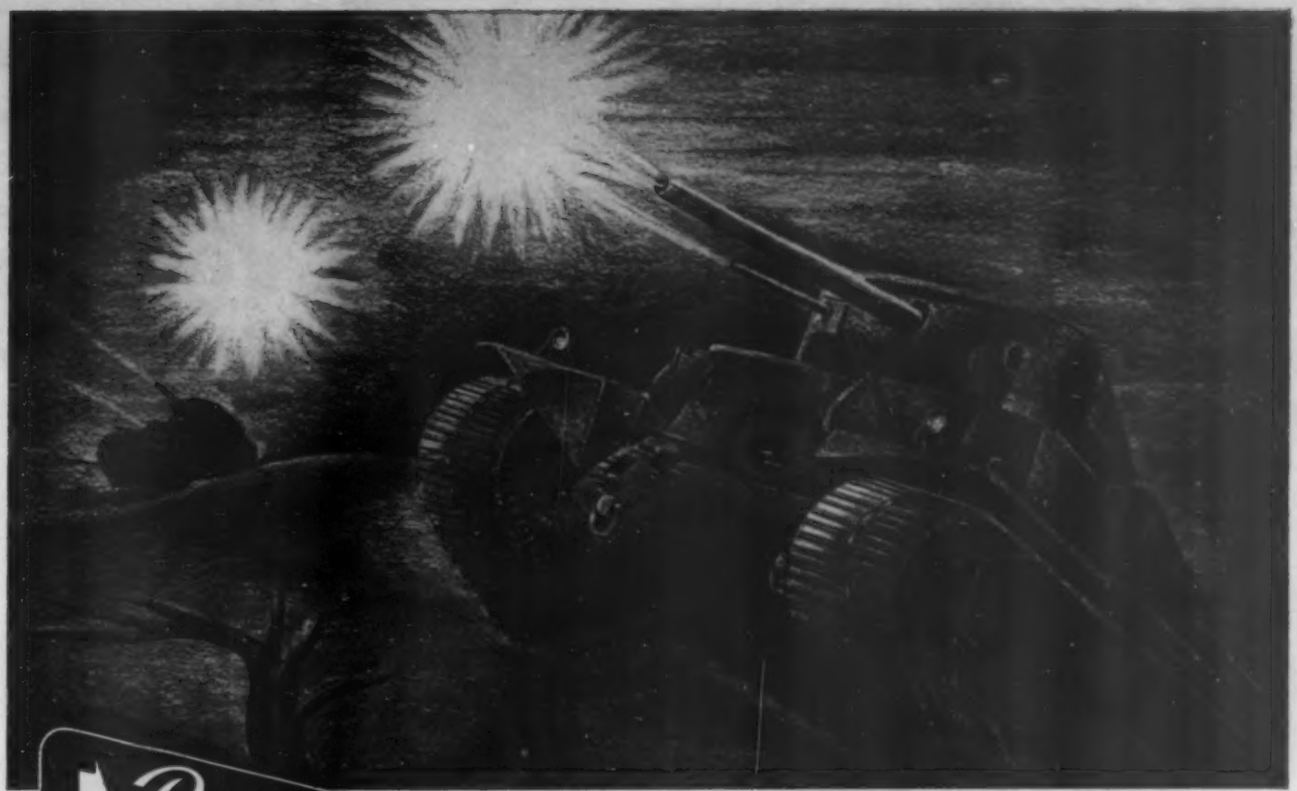
Chromium, hardest industrial metal, prolongs mold life almost indefinitely. When chrome wears out, the mold can be replated. The same is true of all moving machine parts: press rams, gears, etc. Damaged parts can be salvaged through the application of hard chromium plate. Our special HC chromium plating method is playing a key conservation role in war industry. Let us show you how it can save you time, speed production, cut costs.

(HC stands for Hard Chromium, our special plating process)

INDUSTRIAL HARD CHROMIUM CO.

15 Rome Street — Newark, New Jersey

Hard Chromium Specialists



Reilly INDUR PLASTICS

RESERVED FOR WAR SERVICE

● REILLY INDUR PLASTICS are peculiarly qualified for the exacting requirements of war service by reason of their light weight, superior structural strength, easy molding qualities, high electrical resistance and ability to withstand moisture, oils and most acids. Because of these characteristics INDUR PLASTICS are being used in the manufacture of scores of instruments, devices and parts which are directly or indirectly essential to the production of tanks, ships, fighting planes and other war equipment.

If you are making any of this type of equipment, we will be glad to discuss your requirements with you.

REILLY TAR & CHEMICAL CORPORATION

Executive Offices:
MERCHANTS BANK BUILDING, INDIANAPOLIS, INDIANA
2513 S. Damen Ave., Chicago, Ill. • 500 Fifth Ave., New York, N. Y.
St. Louis Park, Minneapolis, Minn.

SEVENTEEN PLANTS TO SERVE YOU

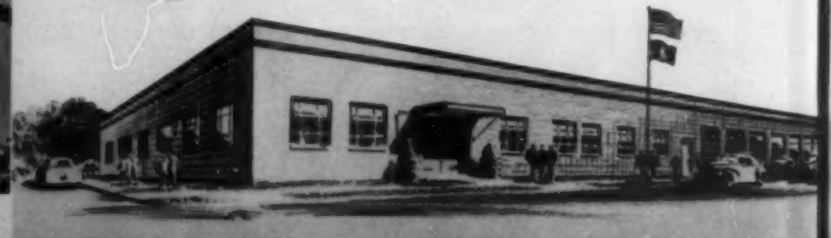
REILLY INDUR PLASTICS

"FOR HIGH ACHIEVEMENT IN THE PRODUCTION OF WAR MATERIEL..."

so reads the letter from Robert P. Patterson, Under-Secretary of War, announcing the War Department's designation of Franklin Plastics to receive the coveted and distinguished Army-Navy Production Award.

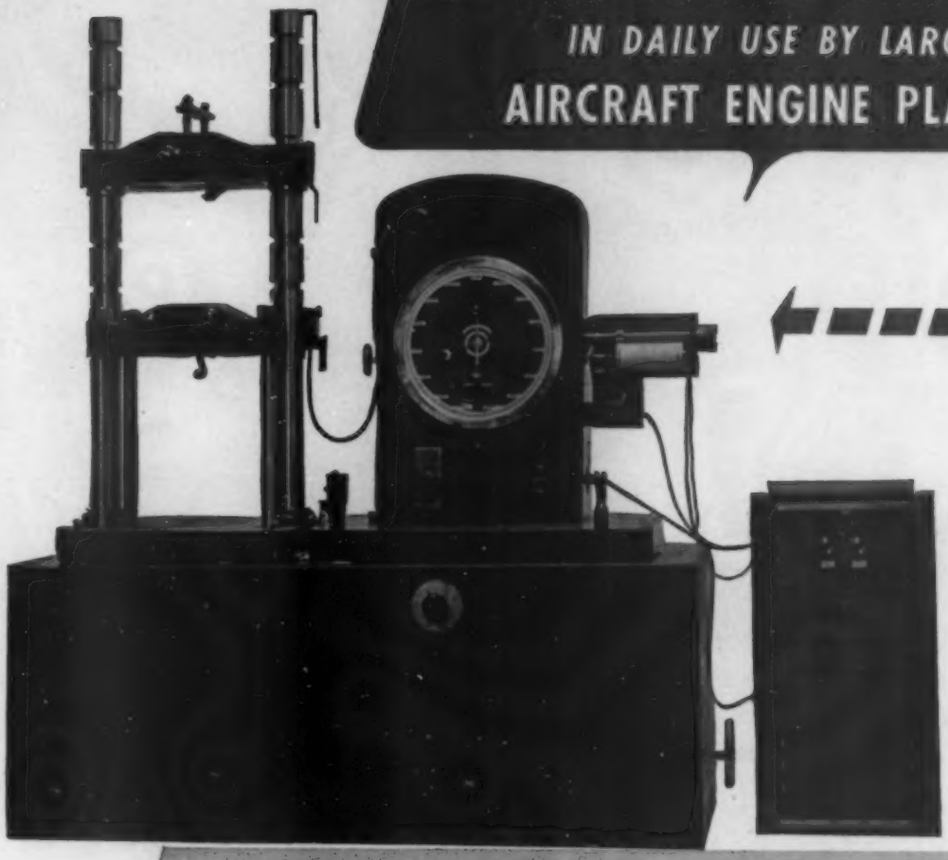
The remarkable production record of war materiel by Franklin Plastics that merited this inspiring recognition stands alone . . . indisputable evidence of our preparedness to serve you and our country in war or peace.

The management extends congratulations and whole-hearted thanks to all of its employees . . . and others whose efforts have made this award possible. The flag which flies over our plant is a constant reminder to spur us on to even greater efforts in the future.



f franklin plastics division • FRANKLIN • PA.
Robinson Industries, Inc.

OLSEN 120,000 LB. UNIVERSAL WITH HIGH MAGNIFICATION RECORDER IN DAILY USE BY LARGE AIRCRAFT ENGINE PLANT



The physical characteristics of a material are never so clearly seen as when magnified and recorded on a stress-strain diagram. New values are set forth which are vital in order that service conditions and proper safety factors may be met. An Olsen Universal Testing Machine with High Magnification Recorder puts the following information at your finger tips:

1. Modulus of Elasticity
2. Hysteresis
3. Elastic Deformation
4. Proportional Limit
5. Yield Strength (Yield Point)
6. Proof Stress (Proof Strength)
7. An aid in fatigue problems
8. An aid in cold working problems.

Olsen Universals with High Magnification Recorders are doing two vital jobs for industry today:

1. Making materials acceptance and inspection a routine production operation.

2. Putting on one chart sheet the stress strain diagram of any material so that all basic characteristics are clearly seen in their relative lights.

TINIUS OLSEN TESTING MACHINE CO.

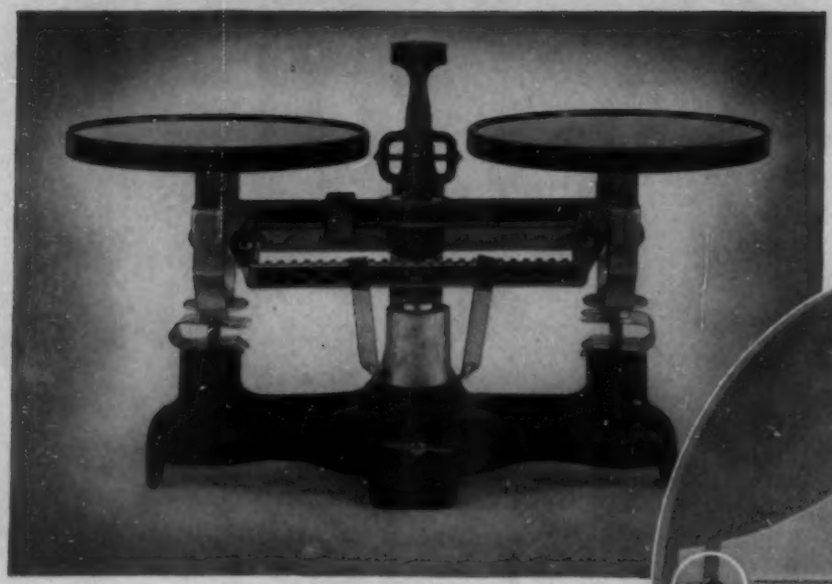
580 N. TWELFTH ST. PHILADELPHIA, PA.

Western Representative: **PACIFIC SCIENTIFIC COMPANY**

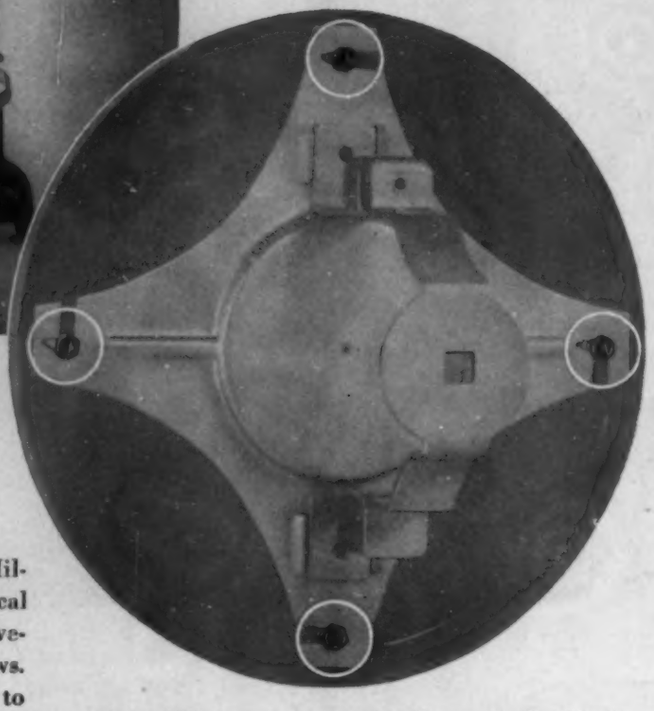
LOS ANGELES SAN FRANCISCO SEATTLE

Proving Every Day that the Value of Testing Depends on the Quality of the Testing Equipment.

Metal to Plastic



–another example of trouble-free changeover



CHICAGO APPARATUS CO. solves a fastening problem with P-K Self-tapping Screws . . . improves design . . . achieves new production economy . . .

When war conditions compelled the redesign of the Milvay-Double Beam Tip Scale to reduce the amount of critical metals required, the manufacturer made several improvements with the help of Parker-Kalon Self-tapping Screws.

The pans were formerly made of metal, and fastened to the "spider" underneath by metal clips gripping the edges. The pans are now made of plastic (bakelite) and are attached to a simplified "spider" with Parker-Kalon Type "F" Slotted Hex Head Self-tapping Screws. The clips are eliminated, and the tops and sides of the pans are clear for easy cleaning.

Because P-K Self-tapping Screws had been used successfully by this manufacturer in metal assemblies, it was quickly recognized that their many advantages would apply equally well to plastics.

If you are planning a changeover to plastic parts, of any type, be sure to *question every fastening.* P-K Self-tapping Screws will in many cases prove to be the most satisfactory and economical means of assembly. For assistance in making a complete analysis of your fastening problems, call in a P-K Assembly Engineer. Or, send assembly details for recommendations by mail. Parker-Kalon Corp., 190-200 Varick St., New York, N. Y.

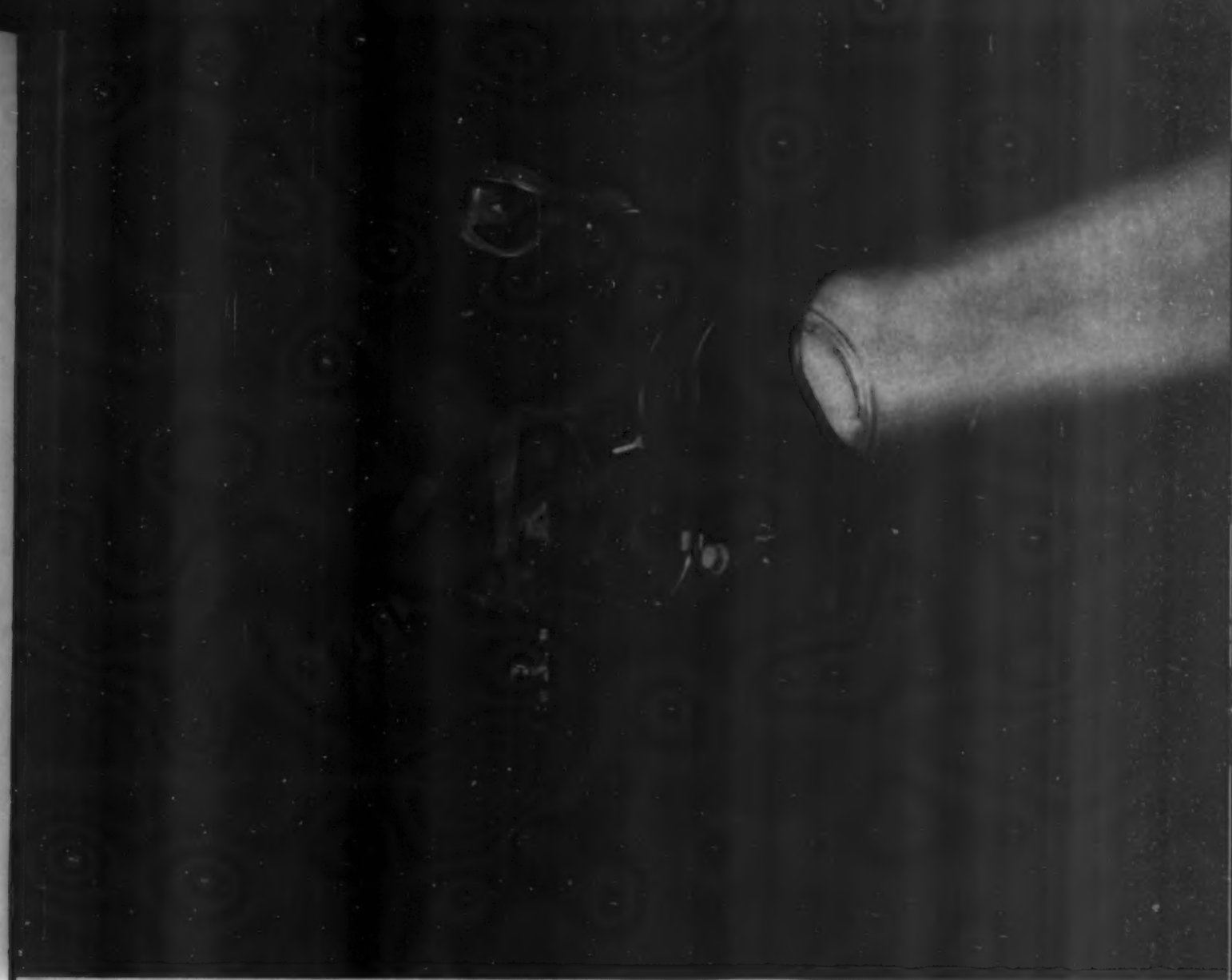
Four P-K Screws are used to fasten the "spider" to each pan. One easy operation – turning the Screws into molded holes – makes a more secure assembly than machine screws even in tapped metal inserts.

Because P-K Type "F" Screws tap their own strong threads as they are driven, no tapping, no costly metal inserts, are necessary. Assembly is faster, and production costs are considerably lower.

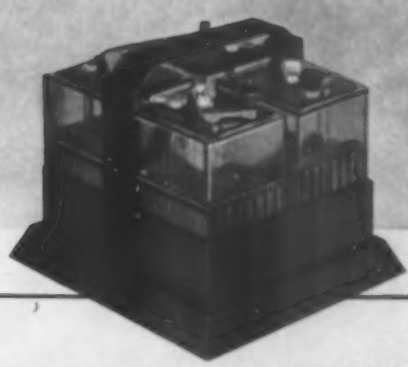
A TYPE FOR EVERY METAL OR PLASTIC ASSEMBLY

PARKER-KALON
Quality-Controlled
SELF-TAPPING SCREWS

Give the Green Light to War Assemblies



With this searchlight you can see the future . . .



POWERED BY AN 8-VOLT storage battery, this portable searchlight sails on convoy duty, rides with the crash trucks at air bases, stands guard against sabotage at arsenals, war plants and docks. Its 75,000 candlepower beam throws light for miles.. and, *because its 4 wet-cells are housed in cellulose plastic*, throws light significantly on the future.

NOW, AND FOR YOUR 194X CAR, these are the advantages of the cellulose nitrate housing: *Transparency*—one quick glance and you see exactly the electrolyte level inside each unit. *Light-weight*—plastic instead of rubber means a saving (in this battery) of one full pound of weight. *Toughness*—cellulose nitrate is so tough that the battery meets the test of a 12-foot drop on concrete. Cellulose nitrate plastic is *acid-resistant*, and a *non-conductor*. Fabricating it is simplicity itself. What better combination for portable power plants . . . now in war, and later in peace?

NITROCELLULOSE, THE COMPOUND on which this plastic is based, has long been a special interest of Hercules. If you would like information and data about Hercules nitrocellulose, your letter addressed to Department MP-23 will receive prompt attention.

•

Plastic battery jars for the Dewar Portable Searchlight, made of Celluloid by the Celanese-Celluloid Corporation.

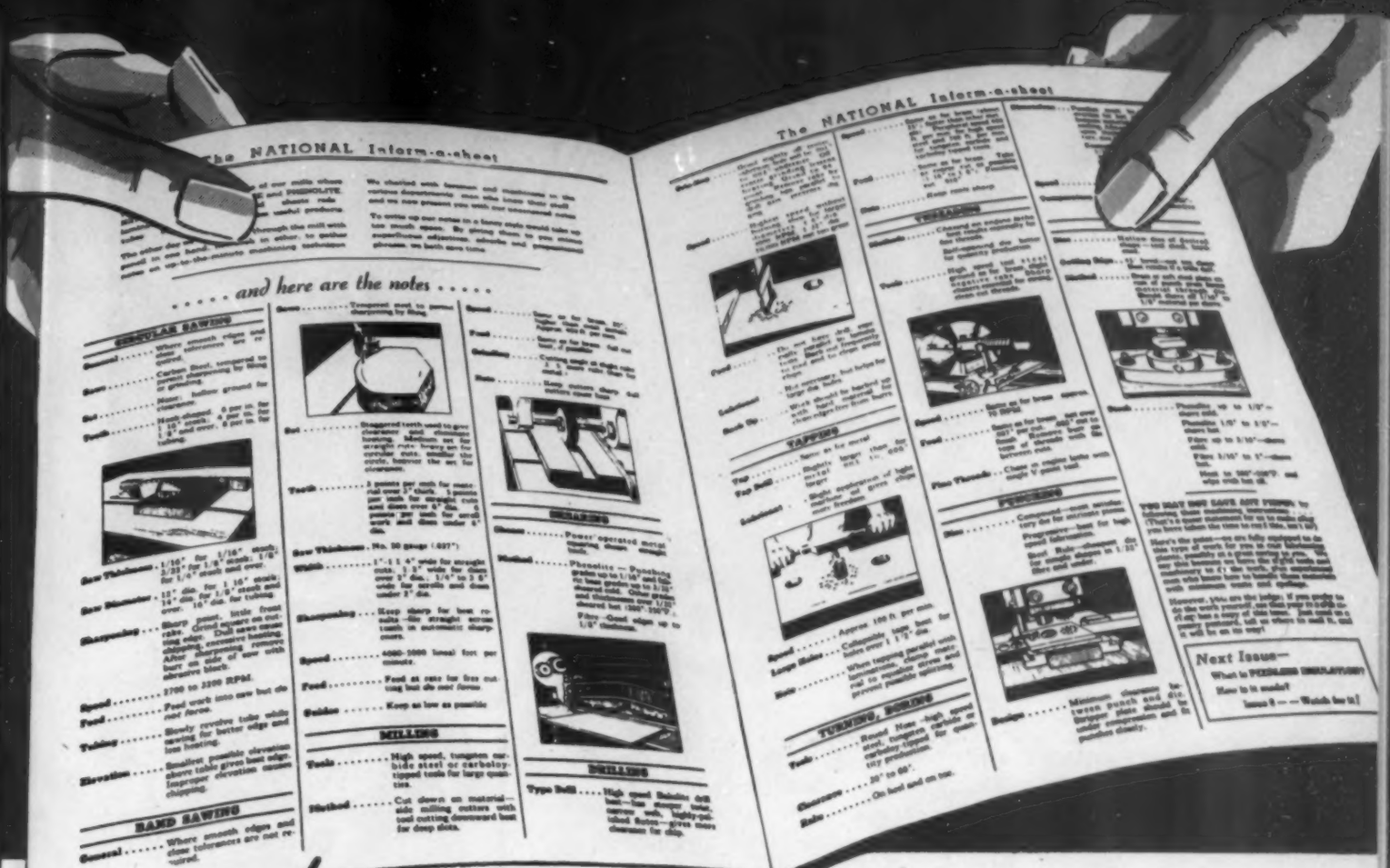
HERCULES

CELLULOSE NITRATE

★

TRANSPARENT • STABLE • LIGHTWEIGHT
FLEXIBLE • TOUGH • ECONOMICAL

HERCULES POWDER COMPANY *Incorporated* **· WILMINGTON, DELAWARE**



Here's how you can teach new employees to machine efficiently . . . . .

NATIONAL VULCANIZED FIBRE & PHENOLITE

This "National Inform-a-Sheet No. 5," shown above, contains easy-to-read, easy-to-understand data on how to machine National Vulcanized Fibre and Phenolite, laminated Bakelite practically and efficiently. The information is simply presented and illustrated so that new hands can be taught quickly the correct fabrication of these materials. You can save time and trouble and conserve material through using this technical bulletin. Ample quantities of the bulletin are available on request.

NATIONAL VULCANIZED FIBRE CO.

WILMINGTON DELAWARE

Offices in Principal Cities

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

War Production Calls for the Conservation of Materials through Proper Methods of Handling

Use this Coupon for ordering

FREE COPIES of "NATIONAL INFORM-A-SHEET NO. 5"

National Vulcanized Fibre Co.
1000 Maryland Ave., Wilmington, Delaware

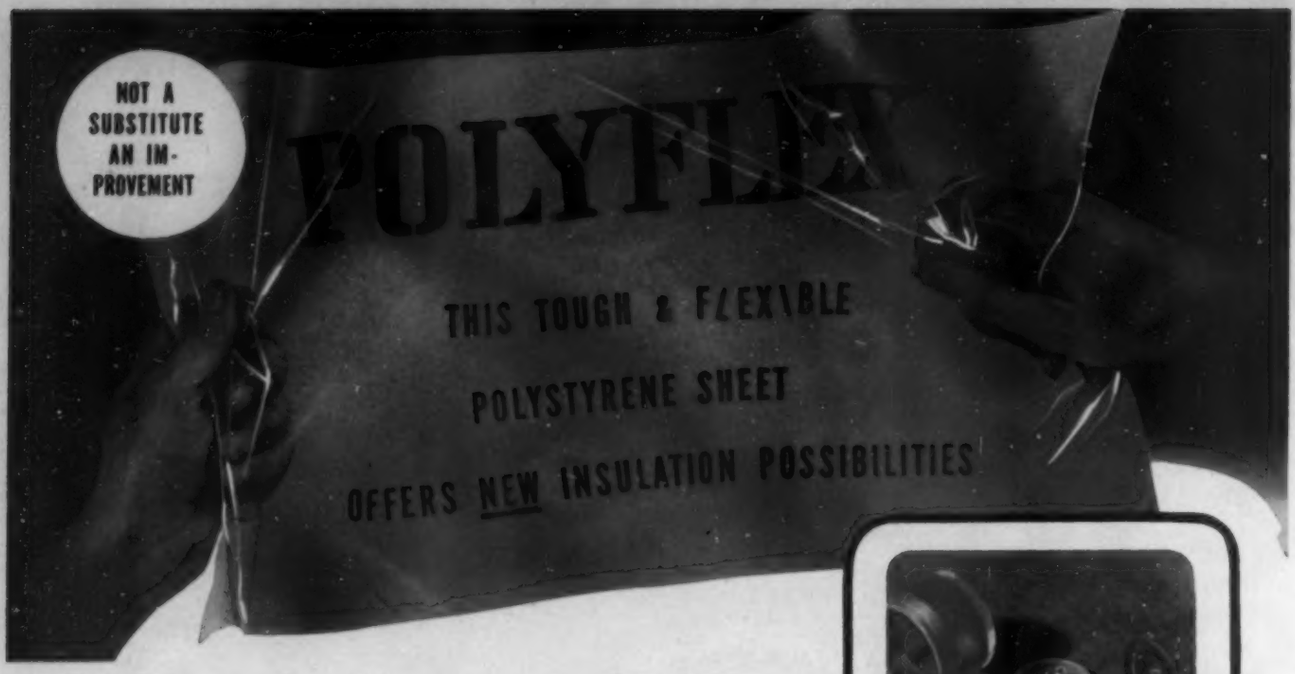
Please send us _____ copies of "National Inform-a-Sheet No. 5"

Individual _____

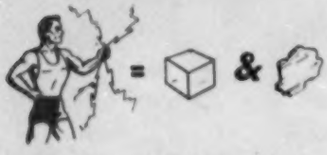
Firm _____

Address _____

M



EQUALS QUARTZ and MICA ELECTRICALLY



Polyflex has "the dielectric strength of an excellent grade of mica and the low dielectric loss of fused quartz."* (Excepting flexibility, all Polyflex characteristics also apply to Plax polystyrene parts described at right.)

REALLY TOUGH and FLEXIBLE

To polystyrene's startling electrical properties, Polyflex adds *tough* paper-flexibility, adapting it to wide use by condenser, storage battery, cable and other manufacturers.

UNAFFECTED BY WATER, ACIDS OR ALCOHOL

Polyflex's "low water absorption (.00) cannot be approached by any other plastic material."* Weather, acids, alkalis, alcohol, stack gases, etc. . . none of these enemies of electrical equipment affect Polyflex.

PRODUCED TO YOUR SPECIFICATIONS

Tell us what widths, thicknesses, and tolerances interest you. Polyflex is easy to handle in punching and stamping operations. Samples are immediately available. Plax's exclusive Polyflex production is readily adaptable to your needs. Please get in touch with Plax today.

*Modern Plastics, Sept., 1941

PLAX MACHINED POLYSTYRENE PARTS ALSO OPEN A NEW WORLD

Engineers are stimulated (and helped) by inspection of Plax parts. From sheets, rods, and tubes, Plax machines special and standard electronic parts in any quantity, to any degree of accuracy . . . on time. They can improve every segment of any circuit, from power supply to antenna. Please ask Plax for details today.

ELECTRICAL PROPERTIES OF PLAX POLYSTYRENE

Arc resistance (ASTMD-495-38T) sec 240-250. Dielectric strength, volts/mil:

.005" thick = 3500
.010" thick = 2500
.015" thick = 2200
.125" thick = 500-700

Frequency Cycles	Dielectric Constant	Power Factor
60	2.5-2.6	.0001-.0002
1,000	2.5-2.6	.0001-.0002
1,000,000	2.5-2.7	.0001-.0004

PLAX CORPORATION 133 WALNUT ST. HARTFORD, CONN.

"PLASTICS

ARE THE GREAT COMING MATERIAL"

...WHAT DOES THAT MEAN TO YOU ON A PRACTICAL BASIS?

From all sides we hear the familiar statement, "After the war Plastics will open a new world of manufacture." ★ Sounds pretty! It's certainly true! Yet what does that statement mean to you on a practical basis? How can you capitalize the coming importance of Plastics? What fields shall you specialize in? What technical changes will your products require? What are the economic factors to be encountered in post-war markets? ★ Our Plastics Planning Board is prepared to sit down with you and work out the answers to those and other questions. Answers that will fit your own specific business, your own field of manufacture, your own Plastic products, your own individual problems. ★ If you want the facts and figures absolutely essential to planning the foundation for post-war operation... write to our Plastics Planning Board. Let it begin now to function as your advisory board... to prepare the necessary preliminary survey. Inquiries are invited.

*Member of A. C. C. L.

UNITED STATES TESTING COMPANY, INC.

ESTABLISHED 1880

HOBOKEN, NEW JERSEY

NEW YORK · PHILADELPHIA · GREENSBORO · WOONSOCKET · CHICAGO

*American Council of Commercial Laboratories

BEHIND

THE MAN AT THE FRONT

Hobbed Cavities *by* Midland . . .

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

★ ★ ★ Standing firmly behind every U. S. battlefront is a production front—determined and united...getting ships, planes, tanks and guns where they are needed when they are needed—without fail, without falter.

Midland is proud of the privilege to be part of that production front—proud that our hobbed cavities produced on presses ranging from 100 to 3000 tons, delicate engraved cavities and complete molds are contributing so much to the manufacture of intricate plastic parts so essential to front line warfare.

MANUFACTURERS OF BULLET PROFILING DIES

D&E

MIDLAND DIE AND ENGRAVING COMPANY

1800 W. BERENICE AVENUE . . . CHICAGO, ILLINOIS

Makers of Plastic Molds • Die Cast Molds • Engraved Dies • Steel Stamps • Hobbings • Pantograph Engraving

Mills-Plastic Fittings

Your signature on your letterhead brings you our Injection Molded Plastics catalog containing data and illustrations of molded thermoplastics and our MILLS-PLASTIC Circular.

MILLS-PLASTIC* S. A. E. type fittings are being used throughout the country as a companion to our chemically resistant tubing. These fittings are designed for high working pressures and through the efficient method of injection molding threads are molded and faces knurled. These fittings have quickly taken the place of brass, copper and other metal fittings in thousands of practical applications when plastic fittings became available as a replacement.

The fittings include the flare coupling nut, flare type union coupling, half union (adapter) with one end flared for tubing and the other threaded for pipe, the flare to flare T, and the flare to pipe elbow.

MILLS-PLASTIC fittings are now available in the following sizes: 1/8", 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", 5/8" and 3/4". Other sizes are available on special order.

Injection molded MILLS-PLASTIC is also adaptable for such articles as spray gun handles, vials, valve seats, acid dippers, collapsible tubes, filter parts, nozzle tips, telephone plug insulating sleeves, guide rollers and many other items that were formerly made of other materials.

We shall be glad to assist you with information about MILLS-PLASTIC or any other thermoplastic problem confronting you. Consult our engineers without obligation.

Made of Saran

ELMER E. MILLS CORPORATION

MOLDERS OF TENITE, LUMARITH, PLASTACELE, FIBESTOS, LUCITE, CRYSTALLITE POLYSTYRENE, STYRON, LUSTRON, LOALIN, VINYLITE, MILLS-PLASTIC, SARAN AND OTHER THERMOPLASTIC MATERIALS.

812 WEST VAN BUREN STREET • CHICAGO, ILLINOIS

WHY do they come from all over the country to Detroit for extruded plastics?

Should we be coy and pretend we don't know?

Let's not boast—probably it's because we were the first in the field of dry (modern) plastics extruding.

Maybe it's because we have *stayed* first in that field—introducing extruded plastics to such basic industries as automotive, refrigeration, furniture . . . . and now for war.

Maybe it's because they like the way we tackle new problems, and solve them so they stay solved. Our experience has taught us about the little bugs that bite people who rush into plastics too fast or without adequate pre-testing.

We could go on . . . . bring us your problem and we'll *show* you, whether you're from Missouri, California or New York.

DETROIT MACOID

CORPORATION

12340 Cloverdale Ave. Detroit, Michigan

ORIGINATORS OF DRY PROCESS PLASTIC EXTRUSION

HYDRAULICS
Rodgers
KEEP THE WORLD MOVING

Visions of Today

Manufacturers of:
UNIVERSAL HYDRAULIC PRESSES
TRACK PRESS EQUIPMENT
HYDRAULIC KEEL BENDERS
HYDROSTATIC TEST UNITS
POWER TRACK WRENCHES
HYDRAULIC PLASTIC PRESSES
PORTABLE STRAIGHTENER
FOR PIPE AND KELLYS

☆

Buy U.S. War Bonds and Stamps!

AT THIS CRITICAL MOMENT of our history, Americans are called to be creators, the makers of a new order of civilization. Every individual must play his part with keenness and enthusiasm, and every common task must make some contribution to a United Victory. It is not enough to gaze in wonder at the latest inventions of the mind of man. We must look with prophet's eyes beneath the surface of things, and beyond the events of the moment to the things that are to come. Thoughtful people everywhere are looking to the future.

Today, the aviation industry has found it both possible and practical to use plastics and plastic ply-wood for many of its needs. Within the range of immediate possibilities are huge airliners, swift, sleek and strong, manufactured almost entirely of plastic materials. These huge airliners will be able to double their freight and passenger capacity, at speeds beyond our imagination, and at greatly reduced operating costs. Safety will be an important factor in these new airliners of the sky.

Tomorrow, when the critical days are over, and Victory is assured, Rodgers Hydraulic Moulding Presses will be available again.

Today, we are devoting our entire resources to the overwhelming defeat of the Axis and their systems of barbarous oppression. Rodgers Hydraulic Inc., St. Louis Park, Minneapolis, Minnesota.

Rodgers HYDRAULIC Inc.

Improve the performance of your plastics equipment for Victory with Timken Bearings. The more you use, the better the performance.

Whether you manufacture specialized plastics equipment such as rolling mills, molding presses or extrusion machines, or standard machines adaptable to some phase of plastics production — such as lathes, drilling machines, abrasive machines, etc., you need Timken Tapered Roller Bearings.

A few Timken Bearings will make any machine a better machine, but if you want the utmost in speed, precision and endurance you need them at every suitable position, thus assuring complete protection against friction; wear; radial, thrust and combined loads; and misalignment of moving parts.

If your engineers are making full use of Timken Bearings they are giving you machines that *sell better* as well as machines that *perform better* — for the trade-mark "TIMKEN" is a buying guide to thousands of machine users. The Timken Roller Bearing Company, Canton, Ohio.

"All There Is In Bearings"

TIMKEN

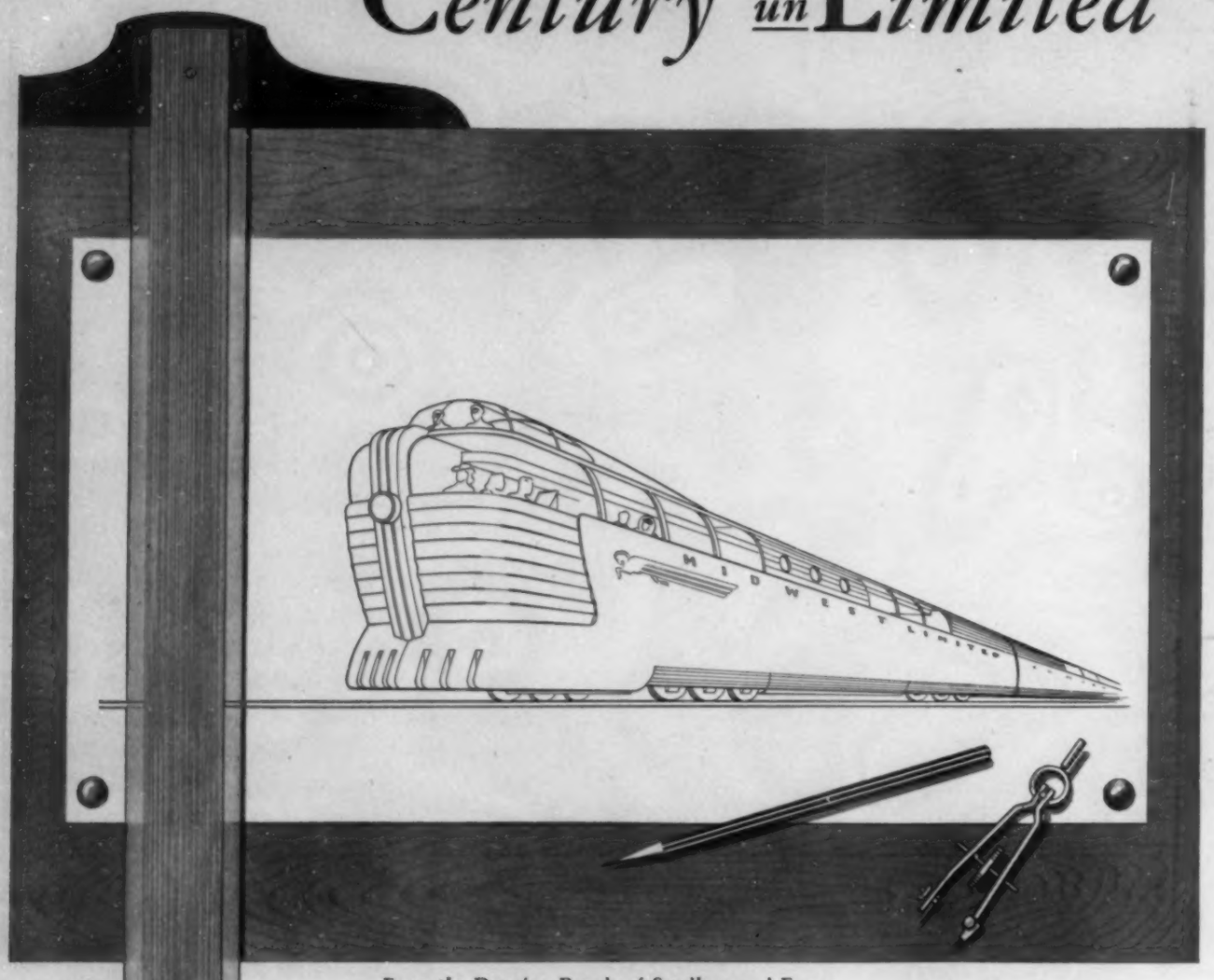
TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

The One Test For Every Decision—*Will It Help To Win The War?*

Sectional view of Racine Variable Volume Hydraulic Pump equipped with Timken Bearings on the rotor shaft. These pumps are used to furnish hydraulic power for machines of all kinds.

Preview of the Century unLimited



From the Drawing Boards of Sundberg and Ferar

We say "Preview." Of course, the swift, sleek, streamliner shown above has not been engineered or built. It is simply a sound design by qualified designers of what a post-war "Iron Horse" may look like. But this much is certain: plastics will help make the trains of the future faster, more comfortable, more convenient, and cheaper, too. Say designers Sundberg and Ferar: "Tomorrow's trains could be lower, lighter, more stable. Plastics? For the engineer's turret. For windows extending to the roof. Lighting fixtures, hardware, venetian blinds, upholstery. For countless decorative and structural applications."

When you're thinking today of plastics for your post-war products we suggest you talk over your ideas and problems with Kurz-Kasch designers, engineers, tool makers and molders. And they, too, are thinking ahead. They've been thinking ahead ever since the humble beginnings of the plastic industry a generation ago.

KURZ-KASCH

Planners and Molders for the Age of Plastics

Kurz-Kasch, Inc., 1417 South Broadway, Dayton, Ohio.
Branch Sales Offices: New York • Chicago • Detroit • Los Angeles • Dallas • St. Louis • Toronto, Canada. Export Offices: 89 Broad St., New York City.

Plastic Plumbing HERE TODAY...MORE TOMORROW

Toilet float molded of Celanese-Celluloid Corporation's Lumarith by Allied Plastics Corp. for Kirkhill Inc.

CALLED ON TO PINCH HIT for scarce metals, acetate plastics end up by winning a place in the permanent line-up on many teams. A case in point may be the toilet float molded of this versatile material.

ARCHITECTS, DESIGNERS, MANUFACTURERS of building accessories have had their imaginations fired by the endless possibilities of acetate plastic. Combined in one material are offered stability and toughness, flexibility and lightweight, dielectric strength and resistance to destructive agents. Costs are reduced by rapid fabrication and re-use of scrap.

THE COUNTLESS NEW APPLICATIONS for acetate plastics—appearing now with rapid acceleration—have their foundation in our long and continuous research in cellulose chemistry. From this research comes the exceptional quality of the acetate we supply to those who make plastics. For literature, address Department P-23.

HERCULES

CELLULOSE ACETATE

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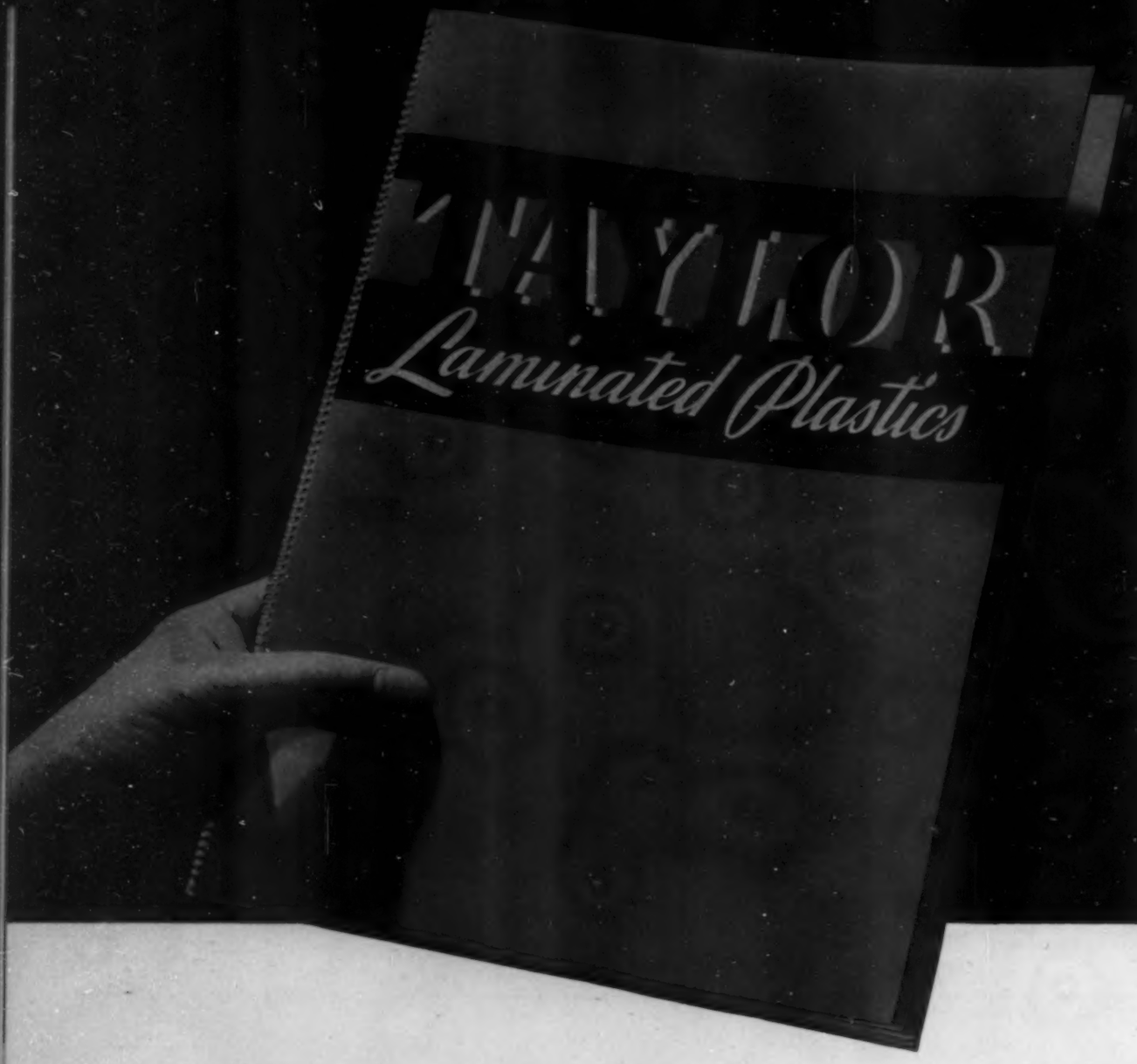
TOUGH • FLEXIBLE • STABLE
LIGHTWEIGHT • ECONOMICAL • CLEAR

HERCULES POWDER COMPANY Incorporated *• WILMINGTON, DELAWARE*

900-67



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Featuring:

Valuable, timely information on Laminated Plastics construction of vital Aircraft Parts... on Vulcanized Fibre and Phenol Fibre for Electrical Insulation... for Radio... for Electronics... for Silent Gears and other mechanical uses. Write for your copy on your business or official stationery.

TAYLOR FIBRE COMPANY
NORRISTOWN, PA.
Pacific Coast Headquarters: 544 South San Pedro Street, Los Angeles, Cal.

TAYLOR

LAMINATED PLASTICS • Vulcanized Fibre • Phenol Fibre • SHEETS, RODS, TUBES, FABRICATED PARTS

Photo U. S. Army Signal Corps

Army goggles of glass and metal before redesign

GOGGLES FOR A STREAMLINED ARMY...ONE OF WAR'S BEST REDESIGNS FOR PLASTICS

THIS is a high-speed, highly mechanized war. As a result, our fighting men need protective goggles in such unprecedented quantities that a year ago production of conventional types (left) from precisely machined metal parts and ground glass was falling alarmingly behind demand. In search of a solution, military optical experts called in the research talent of the Polaroid Corporation—with the happy result you see below.

Frames of these new, all-purpose goggles are simply and quickly molded in one piece from reclaimed rubber. The one-piece lens is fabricated with equal ease from Polaroid films incorporating Monsanto's clear, tough Fibestos (cellulose acetate.) In lenses for protection against glare, polarizing films are used. In those for protection chiefly against wind or in colored lenses for special purposes, films are non-polarizing. The different types are all quickly and easily interchangeable in the one standard frame.

Today, goggles precise enough for specialists like aircraft gunners are being turned out in sufficient quantities to equip every man in our armed forces who needs eye protection.

Four metal snaps hold the flexible, non-breakable, Fibestos lens which is also non-fogging, highly scratch-resistant.

To change a lens takes less than a minute. Several different types are supplied with each frame.

Note how rubber straps and frame hold the goggles snugly and securely to any shape head.

The Family of Six Monsanto Plastics

(Trade names designate Monsanto's exclusive formulations of these basic plastic materials)

LUSTRON (polystyrene) • SAFLEX (vinyl acetal) • NITRON (cellulose nitrate) • FIBESTOS (cellulose acetate) • OPALON (cast phenolic resin) RESINOX (phenolic compounds)

Sheets • Rods • Tubes • Molding Compounds • Castings • Vuepak Rigid Transparent Packaging Materials

MONSANTO PLASTICS

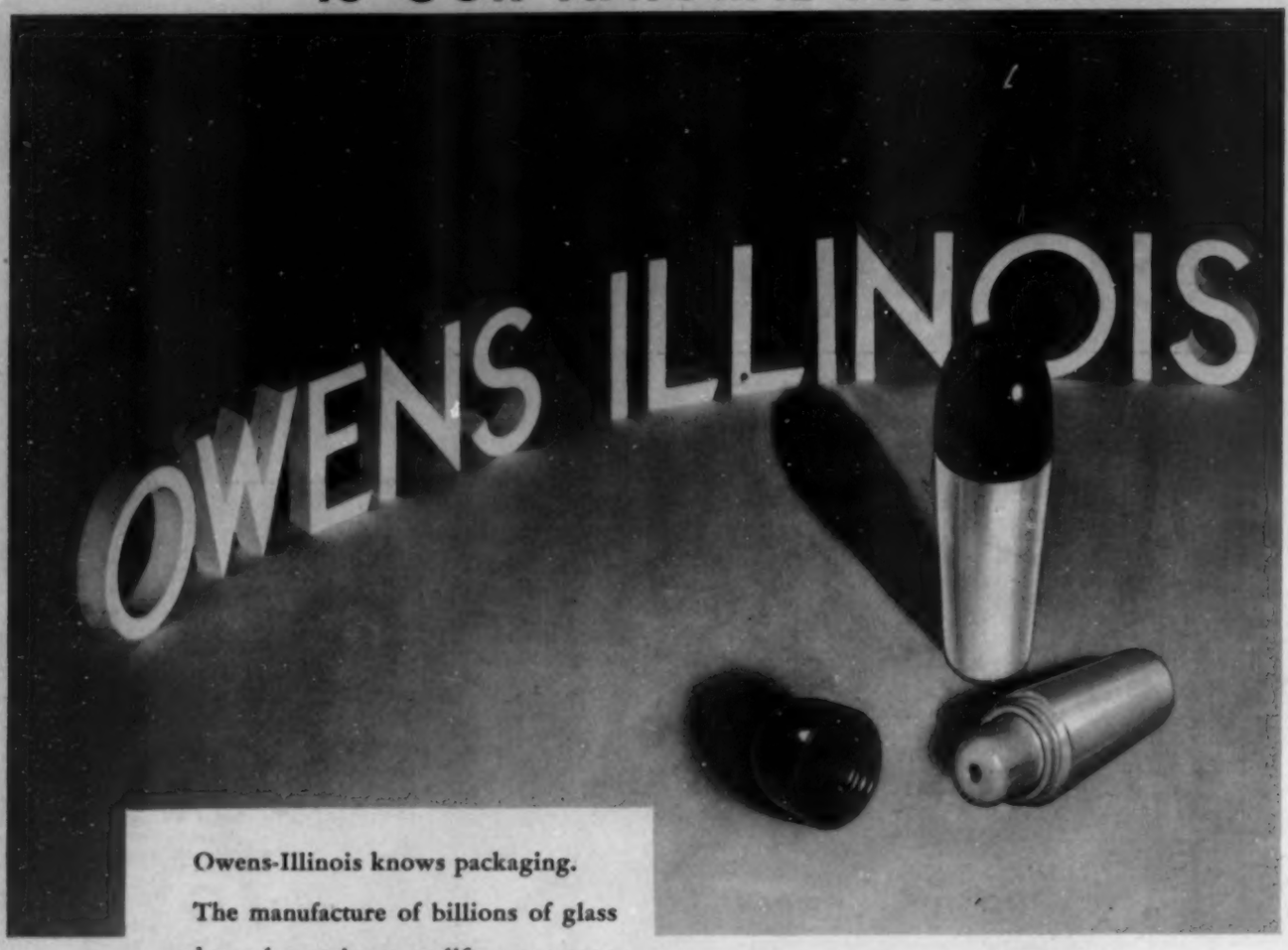
SERVING INDUSTRY...WHICH SERVES MANKIND

At the command of Polaroid technicians responsible for this outstanding job of redesign was another group of experts—Monsanto's technical service engineers and plastics research chemists. Thanks to their quick work, Fibestos formulations ideally suited to Polaroid processes were developed.

With their years of experience and wide knowledge of a broad range of plastics these men are a useful group to have at your service on *any* job. For their help on *your* war or essential civilian job, write or wire: MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield, Massachusetts.

Plastic Packaging

IS OUR NATURAL ASSIGNMENT



Owens-Illinois knows packaging.

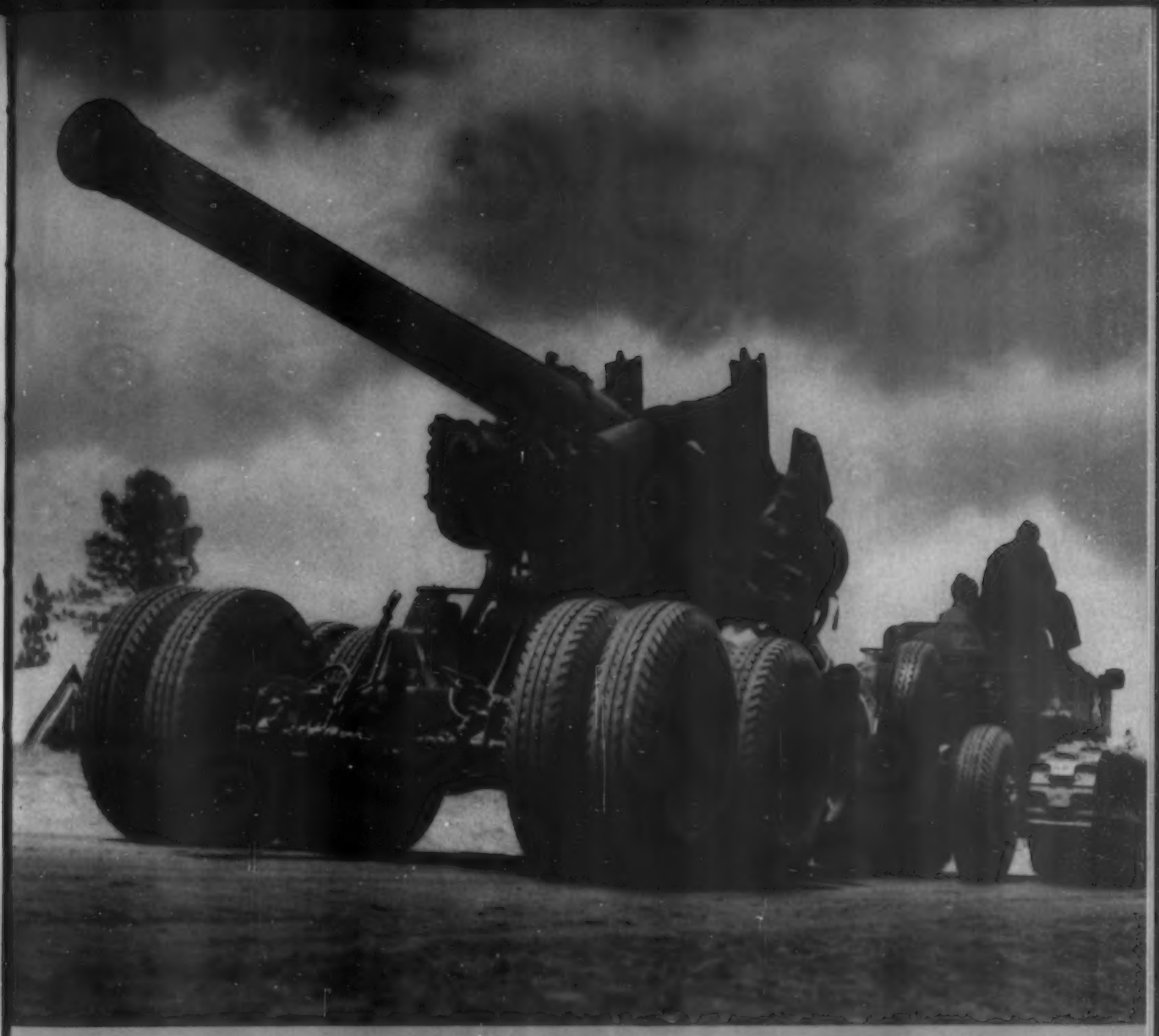
The manufacture of billions of glass and metal containers qualifies us to cope with a myriad of packaging problems. The Owens-Illinois Packaging Research Laboratory is the largest of its kind.

Owens-Illinois knows plastics. Our plastics experts have molded complete packages of plastics . . . and millions of plastic parts for containers.

Our accomplishments in the packaging field are based on this broad background of experience, plus modern facilities. Today's production is, of course, devoted to high priority orders. But, in the post-war period, it is natural that industry will look to Owens-Illinois for *packages of plastic.*

OWENS ILLINOIS

PLASTICS DIVISION . . . OWENS-ILLINOIS GLASS COMPANY, TOLEDO, OHIO



Just Born—But How It Can Talk!

A. Sawed, milled, drilled and threaded packing gland. **B.** Sawed, drilled, milled and tapped fairlead. **C.** Molded, milled and drilled arm contact.

THE 155 mm. gun, biggest weapon of the motorized divisions, uses parts of Synthane Bakelite-laminated.

The properties of Synthane essential for the war-making are the same as those that helped produce better products during peacetime . . . excellent electrical insulating characteristics, structural strength, light weight (half the weight of aluminum), resistance to corrosion from acids, salts, water and solvents, and ease of machining.

When peace returns you will be better prepared if you will think and plan with industrial plastics such as Synthane now.

Synthane contributes to your study of plastics . . . data such as you will find on the back of this sheet.

10% for War Bonds—Treasury Department Honor Roll

Plan your present and future with Synthane Technical Plastics

SYNTHANE CORPORATION, OAKS, PENNSYLVANIA

SHEETS • RODS • TUBES • FABRICATED PARTS

SYNTHANE
Bakelite—laminated

SILENT STABILIZED GEAR MATERIAL

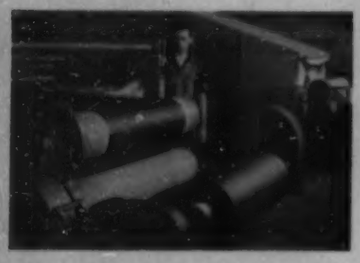
HOW SYNTHANE SHEETS, RODS AND TUBES ARE MADE

SYNTHANE Bakelite-laminated consists of a series of laminations of paper, fabric, or asbestos. Each lamination is impregnated with one or more coats of a Bakelite resin varnish before processing into sheets, rods and tubes.

Bakelite resin is a chemical compound of phenol and formaldehyde. When the two are heated together at a suitable temperature and in the presence of a catalyst to speed up the reaction, a clear amber solid resin is formed. In this stage, the resin can be melted and is soluble in alcohol or acetone.

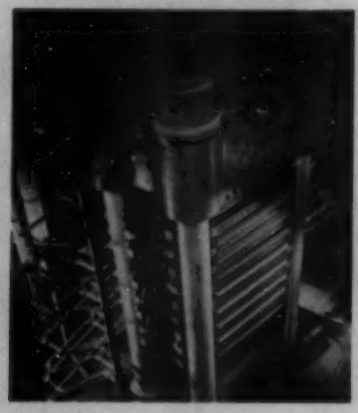
SHEETS

For the manufacture of SYNTHANE the solid resin is dissolved in alcohol to produce a varnish. The fabric or paper is impregnated by passing it over rolls which dip into the varnish. The depth of the coating is controlled by varying the specific gravity of the varnish, or by dipping more than once.



A drying oven, through which the coated sheet passes, evaporates the solvent.

After drying, the roll is cut into convenient lengths to fit the presses. A number of sheets, depending upon the thickness of the finished sheet desired, is piled up in the press. Heat and pressure are applied for a length of time sufficient to complete the chemical



reaction and transform the resin-impregnated layers into a hard and dense solid which will not delaminate, cannot be softened by the re-application of heat, is non-hygroscopic, and possesses excellent mechanical and electrical properties. In the curing process the Bakelite resin or varnish completely polymerizes.

The characteristics of the finished sheet are determined by the grade of resin, type of filler used and time of cure. Those factors are dictated by the job.

TUBES

In the manufacture of SYNTHANE tubes, the bakelized paper or fabric is wound upon a mandrel under heat and very moderate pressure. This operation softens the resin and causes the laminations to stick together. Tubes are usually wound to a slightly greater diameter than called for, in order to provide a margin for grinding to size. In the manufacture of wrapped or rolled tubes, the wound tubes—as they come from the tube winding machine—are oven cured for several hours to complete the cure and form a hard dense wall which will not delaminate nor re-soften with heat.

In making molded tubes, the wound tubes—as they come from the tube winding machine—are placed in a mold, the diameter of which corresponds to the desired outside diameter of the molded tube. Tubes are wound to a diameter somewhat in excess of that corresponding to the mold diameter. The excess material squeezes out of the mold under heat and pressure. The mandrel is, of course, left in during the molding operation just as the mandrel of the wrapped tube is left in during the oven cure.

The final operation on wrapped or molded tubes after the mandrel has been removed is grinding. The tube is passed through the grinder several times, the final cut bringing it down to

size. The tubes are sanded and polished if necessary or finished with any one of a variety of lacquers according to the specifications of the job.

Square or rectangular tubing may be supplied in almost any dimension in the rolled tubing.

RODS

SYNTHANE laminated rods can be made either by lathe-turning sheet stock or by tube molding methods. In the latter case, the impregnated paper or fabric is wound up on a very small mandrel to a slightly larger diameter than that of the mold. The mandrel is withdrawn, the rod is placed in the mold and subjected to heat and pressure. Excess material is squeezed out at the mold-joint during pressing.

SPECIAL SHAPES

Special shapes may be made by constructing a mold and building it up with the required paper or fabric pieces. Molded-laminated shapes possess strength exceeding that of ordinary powder-molded pieces.

Nothing that an aluminum man can have to say about plastics can add to their virtues or subtract from their very genuine possibilities.

Actually, Alcoa welcomes the strides being made, technically and commercially, by this great and ingenious industry.

This is not mumbo-jumbo. It is a distinctly pious thought.

The more folks who get the big idea that the bright hope of industry, postwar, is to do new things new ways . . . the more designers who really get down to cases, the better for all of us. Imagineering is a nationwide must.

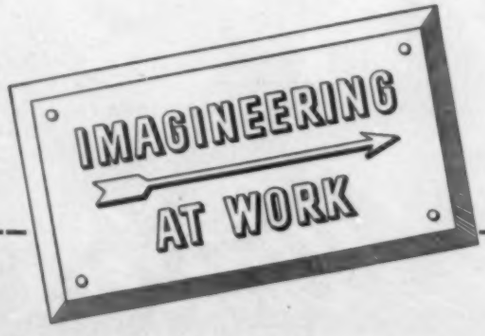
Plastics do many things better than any other material.

Alcoa Aluminum does many things better than any other material.

The two can team up to do a better job for you in certain situations than either could do alone.

As for Alcoa Aluminum, busy seven days a week on war production, we can only remind you that when our strong alloys are again available, you are going to have to throw your old measuring sticks into the scrap heap. New costs, new strengths, new technology, new finishes.

Of such things will postwar jobs be made. On such things must our "eighth-day" thinking be concentrated. ALUMINUM COMPANY OF AMERICA, 2175 Gulf Building, Pittsburgh, Pennsylvania.



Alcoa Aluminum

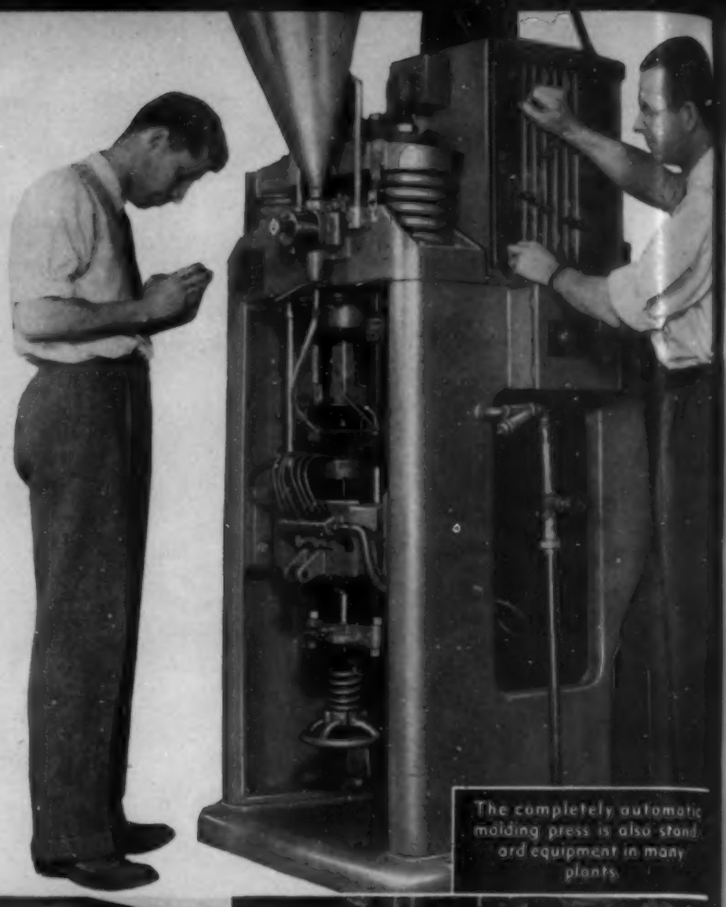
KNOW PLASTICS ENGINEERING AS PRACTICED IN INDUSTRY...

A good time to learn about Plastics is *Right Now*. Plastics are at their highest peak of production. Their extensive use in war application spotlights their importance in many industries when the war is won. Men trained in Plastics engineering have exciting possibilities ahead.

The one-year Resident course in Plastics Engineering at Plastics Institute in Los Angeles, includes both theory and practical training. The machines of the Plastics industry are here for students to use. This, we believe, is important to you in choosing your school.

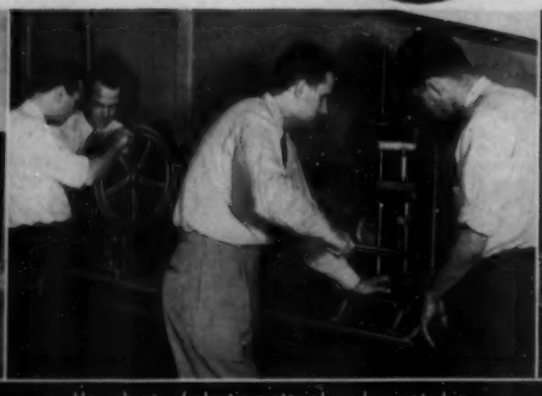
The staff of instructors is of even greater importance in the school you choose. John Delmonte, Technical Director of Plastics Institute, and Dr. John P. Trickey, Assistant Technical Director, are well known in the Plastics industry, with which they have been associated many years.

Plastics Engineering courses start the first Monday in every month. A high school education or equivalent through experience in industry is a prerequisite to joining the group. Complete descriptive literature will be sent on request.



The completely automatic molding press is also standard equipment in many plants.

This standard A.S.T.M. flow tester shows flow properties of molding materials.



How sheets of plastic material are laminated is learned on the laboratory press.

Students have all conventional fabricating equipment for actual practice.

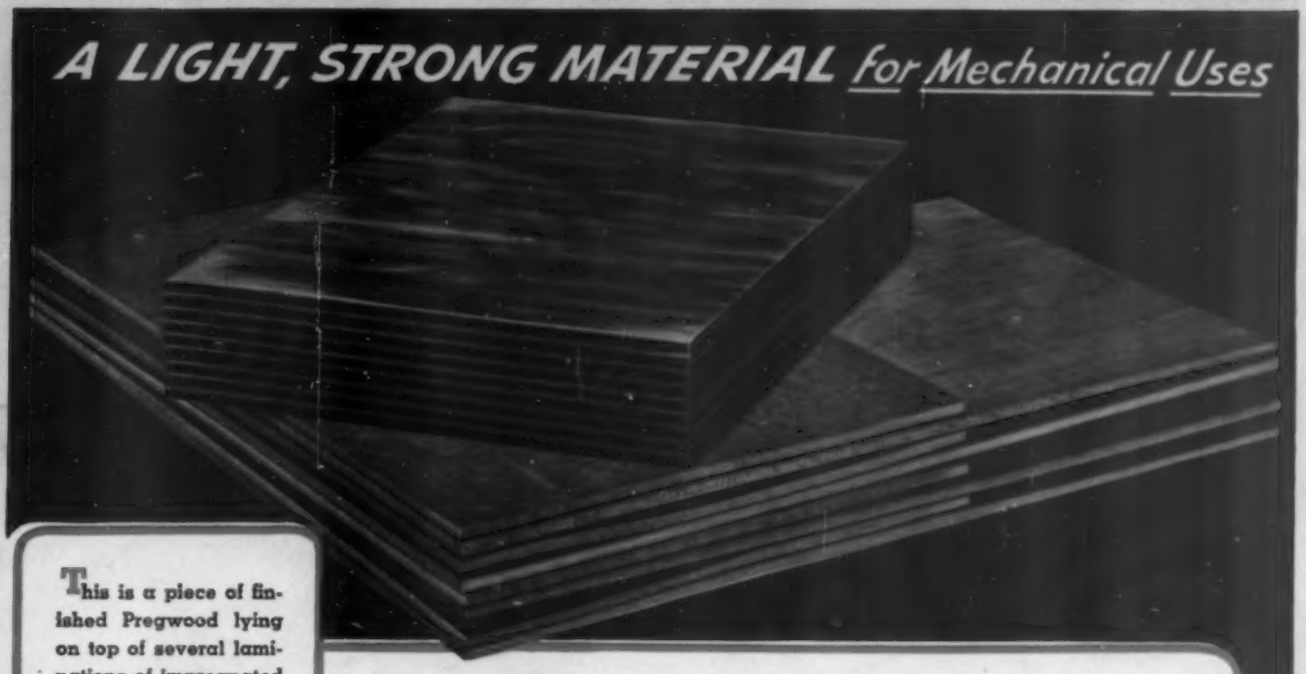
This universal testing machine shows important properties of materials

This huge cold box shows the behavior of plastic materials at low temperatures.

On laboratory compression presses, students learn how commercial products are molded.

"PREGWOOD" FORMICA

A LIGHT, STRONG MATERIAL for Mechanical Uses



This is a piece of finished Pregwood lying on top of several laminations of impregnated but uncured wood arranged to produce "Crossed Grain" Pregwood. The natural wood is reduced to one-half its original thickness when processed. In parallel grain Pregwood the laminations all run in the same direction.

PHYSICAL PROPERTIES OF PREGWOOD	CROSSED GRAIN	PARALLEL GRAIN
Specific Gravity	1.34	1.34
Tensile Strength PSI	12,000	30,000
Compressive Strength PSI	15,000	20,000
Modulus of Rupture in Bending PSI	18,000	35,000
Modulus of Elasticity in Bending PSI	2.0×10^6	2.7×10^6
Izod Impact	4 ft. lbs. per inch of notch	5 ft. lbs. per inch of notch
Shear perpendicular to laminations PSI	5,000	5,000
Shear Parallel to laminations PSI	4,000	
Moisture Absorption Maximum	6 per cent in 24 hours	6 per cent in 24 hours

Pregwood is a composite of wood veneers, thoroughly impregnated with thermosetting resin, compressed to half its original bulk, and cured into a hard, strong homogenious material.

It has great strength, stability of dimensions, and light weight—qualities much appreciated by the aviation as well as many other industries. The material is produced in sheets of varying thicknesses. It can be machined readily to dimensions with the same tools that are used for cast iron.

Pregwood can be successfully glued to wood. It is offered for propeller hubs, complete propeller blades, and for edge strips glued to wood in air frame construction so that the bolts, and fastenings attached through the "Pregwood" will not work loose. Samples on request.

THE FORMICA INSULATION CO., 4673 SPRING GROVE AVE., CINCINNATI, O.

FORMICA

PLASTIC LINERS *for Combat Helmets*

Light plastic liners for the new shrapnel-proof helmets . . . a radical departure from and improvement on the helmets of World War No. 1!

Yes, plastics are playing an important part in this war. For many articles they are inherently superior to metal. They are pinch-hitting on many a job where metals are just not available. And as with metals, surfaces and edges often need cutting down, polishing and buffing to make them smooth and to promote precision in manufacture.

In the field of plastics, as of metals, Lea Technicians are lending a helping hand on such problems. They are thoroughly skilled in the art of preparing and finishing surfaces, and they have the compounds with which to work. The Lea Method plus Lea Compound or Learok, or a combination of both, is now standard practice in hundreds of plants.

THE LEA MANUFACTURING CO.

WATERBURY, CONN.

Burring, Buffing and Polishing . . . Specialists in the Development of Production Methods and Compositions

MELMAC
Heat-Resisting Plastics
STOP THE DIELECTRIC "HOT SPOTS"

It gets damn hot inside a tank and an aircraft engine is no slouch when it comes to radiating b.t.u.'s but Melmac* insulating parts have proved they can take it—*up to 400°F!* And Melmac's high dielectric properties . . . dielectric strength and arc resistance are maintained under the most severe service conditions . . . humidity, dust and dirt, temperature changes.

This comparatively new plastic, developed in Cyanamid's Research Laboratories, is available in several types which have been "field tested" in actual service under wartime conditions. One of these types will undoubtedly meet your requirements. All offer unusual dielectric properties, can be mass-produced by conventional molding methods and equipment, are readily available for essential civilian or military needs. Get the full story on this new plastic insulating material by writing for more information. Our technical representatives will be glad to discuss *your* problem with you, give you full cooperation and arrange for tests.

AMERICAN CYANAMID COMPANY
PLASTICS DIVISION
30 ROCKEFELLER PLAZA, NEW YORK, N. Y.

*Reg. U. S. Pat. Off.

Aircraft engine ignition assembly sleeves and shields are typical applications where the right heat resistance and dielectric strength of Melmac combine to offer a plastic of unusual insulating value. Current wartime demands restrict the commercial use of Melmac to essential needs. Samples for research and testing, however, may be obtained without preference rating.

BEETLE • MELMAC
CYANAMID PLASTICS

MODERN PLASTICS
FEBRUARY 1943 VOLUME 20 NUMBER 6

Lights for bailed-out bales

PHOTOS, COURTESY TENNESSEE EASTMAN CORP.

Colored plastic lamps lashed to aerial delivery containers help troops locate and identify their supplies and equipment

TRANSPORTATION by air—not long ago only the bright dream of air-minded visionaries—has become, in World War II, a military reality and one of the major facets of modern military strategy. A potential solution to one of the most important problems of this global war, that of delivering vast quantities of war matériel and civilian supplies to far-flung fighting fronts and to the shores of our allies, air transportation is beginning to carry its share of the load. Huge cargo planes and gliders are being built to deliver the goods when and where they are needed—furnishing blankets and canned heat to Arctic troops or dropping drums of water to soldiers desert-based in Africa.

But over and beyond its place in the logistics of war, air transport is an important factor in offensive warfare as an adjunct to advancing infantry, especially in the form of flying ferries for parachute troops and their equipment. The "bail out" signal for airborne Commandos leaping into action behind the enemy's lines or for parachute troops serving as spearheads of armies on the march, is the signal also for the simultaneous release of hundreds of smaller parachutes bearing the weapons, provisions and necessary supplies.

Split-second timing determines the success or failure of these daring raiders and fighters. They must be able to retrieve their equipment promptly, to identify each container immediately, and prepare its contents for instant use. In daytime action, bright vari-colored parachutes have been useful for differentiating among several varieties of supplies, but for night raids, an ingenious aerial delivery identification light has been developed—a small, glowing, colored light which leads the soldier to the desired package. Designed almost entirely of plastics, this indicator lamp makes use of colored transparent plastic lens caps (red, yellow, blue, green and clear) to mark the different containers. These containers, which house machine guns, food and other equipment, are dropped from the airplane in a manner similar to that employed in releasing aerial bombs. The parachute, which is a part of the packed container, is used to carry the containers safely to the ground. (*Please turn to next page*)

The identification light, which resembles a flashlight in appearance, is lashed to the top part of the container. A cord is fastened to a fibre insulator set in the external switch of the flashlight, and to a shroud line of the container parachute. When the parachute is opened and released from the airplane, the shroud line natually pulls the cord, moving the fibre insulator from between the switch contacts, thus automatically turning on the light of the indicator lamp. When the package is located by the parachute trooper, the light can be turned off by once again inserting the fibre insulator between the lamp switch contacts.

Developed by the Engineering Division of the Army Air Forces at the Materiel Center, Wright Field, in conjunction with Standard Aircraft Products, Inc., the identification lamp was engineered and designed in plastics in order to obtain a variety of colors, save weight, obtain a high volume of output, withstand all types of weather and climatic conditions, as well as to conserve metal. Black cellulose acetate butyrate was chosen for the body halves, end cap and end plug, and the same thermoplastic in five colors is used for the lens caps.

By his selection of this particular thermoplastic, the manufacturer of the light secured qualities peculiarly desirable in a device upon which exacting demands would be made. The tough butyrate will not crack or chip if the identification light makes a bumpy landing. Its exceptional water resistance will be of advantage in stormy weather or on wet or marshy terrain. Dimensionally stable, the material won't warp and thus endanger the operation of the mechanical parts of the light. With the exception of nuts and bolts used for fastening, the only metal parts used in the lamp assemblies are the two lamp sockets, the switch and the two keepers that are required for lashing the unit to the aerial

2—Assembled identification light and (below) its principal component parts. All parts are molded of butyrate

2

3

3—Two halves of cylindrical body, end cap and plug are molded in one shot in a 4-cavity injection mold

delivery containers and the wire needed as connection to the two lamp sockets.

The identification light is designed to use two standard two-cell flashlight lamps operated in parallel from three type "C" dry cell batteries. Thus, the light output is high —a requirement so that the ground personnel may track the various lighted containers and locate them after they have landed—the life of the lamps and batteries is reduced.

As can be seen from Fig. 2, the complete lamp consists of a cylindrical plastic body, plastic end cap and end plug, two plastic lens caps, one at each end, and miscellaneous metal parts totaling approximately 80 parts in all. Top and bottom halves of the body, along with end cap and plug, are molded in one shot in a 4-cavity mold (see Fig. 3). Note that all holes and threads are molded right into the plastic pieces. In assembly, the two halves are glued together with a solvent cement and the metal contact parts of the lamps are held in place by means of machine screws in combination with lock washers and nuts.

The lenses, which are molded in a 2-cavity mold, have fine internal threads molded in the lower section. The simple, dome-like design of the lens is such that an effective, accurate molding job can be easily accomplished. The upper portion of the dome is broken up by a sunburst design of deep grooves radiating from a magnifying lens projecting from the tip. The lens in the tip concentrates the light and the grooves break up the light rays instead of transmitting a steady beam of light as do most flashlights.

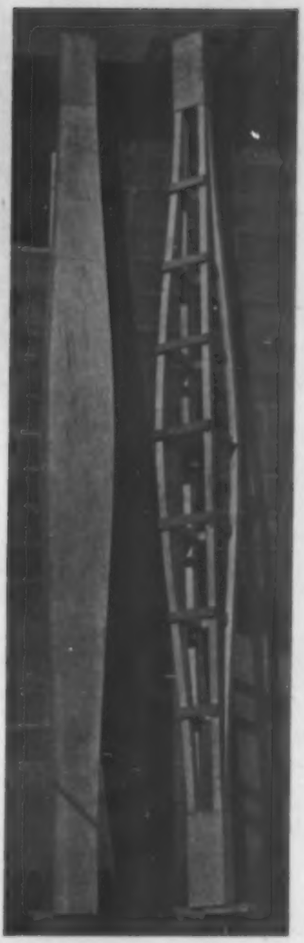
Care in engineering, molding, selection of material and assembly, together with a final inspection of each unit by appointed Army Air Corps inspectors before shipment, facilitate efficient production all along the line. The molder states that the entire time consumed in tooling up for these plastic parts amounted to approximately 8 weeks. Some minor changes made at the end of this period contribute to more rapid production of the parts.

In addition to their present application, these lamps have potential uses as identification lights for all types of packages, such as food and first-aid supplies, delivered by parachute to grounded fliers and "lost" battalions, or to civilian groups isolated by military or natural causes such as earthquakes, floods, etc. And perhaps, in the postwar world of giant cargo planes carrying freight from hemisphere to hemisphere, similar identification lamps will light peaceful commercial packages to their landing fields.

Credits—Material: Tenite II. Molded by Standard Molding Corp. for Standard Aircraft Products, Inc.

Flying flivver garage

PHOTOS. COURTESY MARINE-AIR RESEARCH CORP. 1



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TEXAS won't be much bigger than Rhode Island," runs the lead of an airplane manufacturer's advertisement. "You'll be flying all over the country in a 'Family Car of the Air.'" Construction of these aerial traffic menaces of tomorrow has been postponed until after the victory is won but the plans are on the drawing table and so are the plans for the hangars to house them. The Marine-Air Research Corp. has assembled its first model of a new type aircraft hangar.

This hangar is prefabricated almost entirely of plywood and laminated strips, bonded together with urea-resin glue, which is resistant to moisture, oils, gasoline, extremes of heat or cold and makes a joint stronger than the wood itself. The 40-ft. span experimental model (Fig. 1) is 68 ft. long with a height of 14 ft. at the peak. It is of three-hinge arch design consisting of all-wood prefabricated arches, built up in I-beam sections with laminated cap strips and a plywood web. This particular building was sheathed and lined with exterior grade plywood glued to the framework. The laminated arches are built in two pieces ready for erection but the plywood sheathing is not preformed as it bends readily under a small amount of pressure. No special joint is necessary in the 40-ft. hangar, although larger models will require a modified ball and socket arrangement.

The model was designed to carry a 40-lb. live load but in load tests the arches are reported to have carried satisfactorily over 140 lb. per sq. ft. of roof area. As a result of these tests, this design has been incorporated in plans for a 134-ft. span hangar to be built within the next few months.

The company has also designed and built booms and beams. The boom, which will take tension or compression, was designed particularly for use as a structural member where timber connectors are used. The weight and quantity of lumber employed is a fraction of that of a solid timber of the same strength and the covering affords fire protection. The beam is built up of laminated lumber glued with urea-formaldehyde synthetic resin glues and weighs about 60 percent as much as a solid beam (Fig. 2). A 10-in. by 24-in. by 20-ft. span was designed for an office building with columns 20 ft. each way. This beam, it is reported, withstood a load test of 88,000 lb., equivalent to 220 lb. per sq. ft. of floor area.

The farsighted company believes that after the war, with the inevitable increase in civilian flying, there will be a wide market for a standardized hangar and they expect to have a low-cost, easily assembled unit ready for production then.

Credits: Plaskon glue.

***1**—Hangar prefabricated of plywood and laminqted strips bonded with urea-formaldehyde glue. **2**—A lightweight beam of glued, laminated lumber. **3**—Detail of beams and intercostals is experimental*

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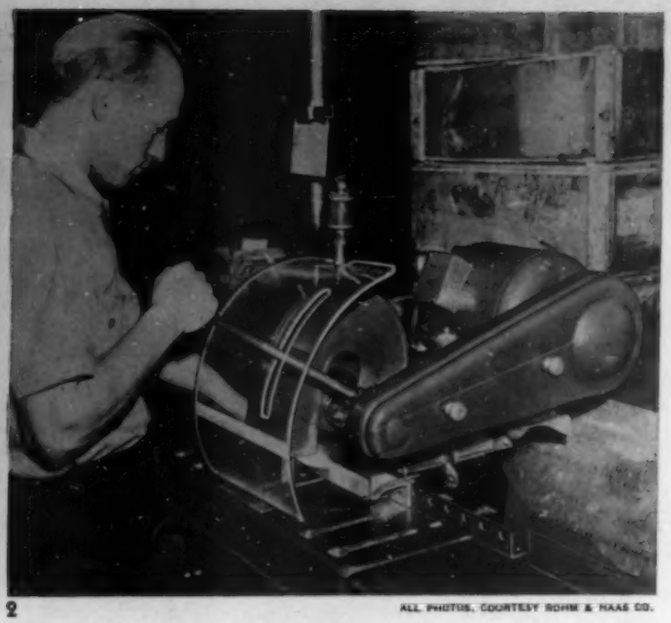

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ALL PHOTOS, COURTESY ROHM & HAAS CO.

Safety devices for aviation plants

by D. S. FREDERICK*

ACCORDING to figures recently made public by the National Safety Council, accidents took the lives of 46,300 American workmen in the year just past. This toll is higher than that taken by all the German bombs that fell on Great Britain since the beginning of the war in 1939.

On the brighter side of the picture is the news that efforts to cut down the industrial accident rate are bearing fruit, in particular at aviation plants, where a variety of new safety devices are already in use. Safety-conscious workers and engineers have been whipping up covers for band saws, drill presses, grinders, soldering equipment and face shields out of the materials at hand in their factories—particularly out of the tough, transparent plastics used for gun turrets and bombardier compartments in the planes they build.

Soldering operations have been safety-insured in Bell Aircraft's Electrical Department by placing transparent acrylic shields over soldering pots. At North American Aviation, a little ingenuity resulted in a clear shield of the same material for band saws. Designed by a worker, the shield either eliminates the need for goggles or, when goggles are necessary, prevents annoying fogging and dirt-clouding.

Consolidated Aviation workers have developed skirt-like bells for drill presses. A simple device for preventing flying dust, these shields were easily made from the clear, transparent plastic.

From thermoplastic acrylic material, Republic Aviation's Methods Engineering Department fashioned shields for their circular saws and other machines which spatter pieces and grinding dust into the faces of operators. Easily formed when heated, these shields were invented to meet exigencies as they occurred. Workers find them easy to attach and to remove for cleaning.

On duty in Consolidated's drilling and chipping operations are lightweight face shields guarding workers against flying splinters. Beechcraft fuselage workers find such shields superior to heavier goggles which protect only the eyes. And North American uses these light, clear shields throughout its plants, with excellent results.

Confronted with the problem of protecting the faces of men working in the anodic heat treating department, where duraluminum parts are anti-corrosion coated by dipping them in huge vats of molten salt, Consolidated engineers worked up a face shield attached to a helmet so that it can be tilted back on top of the head when not in use. Readily formed and quickly machined in the Consolidated plant, the shield protects workers from the 900°F. heat of the bath and from serious burns in case of splashing.

3

* Sales Manager, Plastics Division, Rohm and Haas Co.

4

***1**—Transparent drill press skirt used at Consolidated. **2,3**—The acrylic saw shields used at Republic make wearing of goggles unnecessary. **4**—At Beechcraft, fuselage worker is protected from flying tacks by a tiltable shield. **5**—Acrylic shield guards a North American worker's eyes from shavings of the same material. **6**—A transparent shield over soldering pot in Bell plant prevents spattering of molten metal. **7**—A North American band-saw operator protects his eyes with a device designed by himself*

Equipment for working acrylic plastic is available in most aviation plants. Parts may be shaped with temperatures of 220° to 300° F., using simple forms for desired pieces. Plenty of soap and water or a water solution of a synthetic wetting agent, aided by the worker's bare hands (bare hands have proved more satisfactory for polishing than soft cloth or chamois), do the cleaning trick. Rubbing with a dry cloth may scratch the surface of the material and builds up an electrostatic charge which attracts dust. Damage may be avoided by blotting with a clean damp chamois. Application of a good grade of wax before using prevents scratching.

Despite its tremendous expansion, the aviation industry has had a comparatively low accident loss. Ingenious safety devices such as these, many developed by workers themselves, have undoubtedly contributed considerably.

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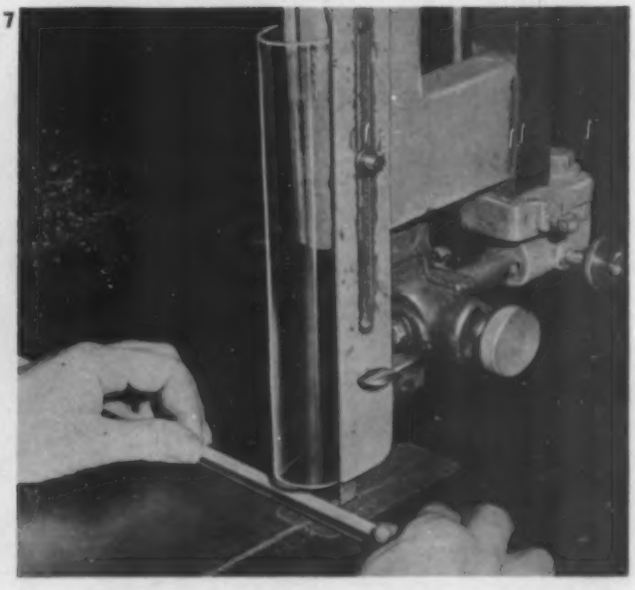


All-plywood motor car body, now being road-tested, has been mounted on a standard chassis

Modeling postwar motor car bodies

FOR the lightweight motor car of the postwar era, Ray Russell, Detroit plastics engineer and free-lance automobile designer, has now evolved a plywood body which he considers to have important possibilities.

The body has been constructed by Russell over a 1941 Chevrolet chassis and motor, and is now being tested for road performance. The designer stresses that this is purely a first experimental effort in the field. He has, as a matter of fact, already gone a step farther with the construction of a scale-model car of plywood (below) which has not a single compound curve. This completely streamlined design suggests significant economies in future automotive construction.

These experiments have aroused considerable interest in the automobile industry, and two possibilities are cited:

That if an "interim" automobile should become necessary, after a few years of war, to take care of vital highway transportation, the plywood body might be used over present chassis and motors with a great saving in steel.

That in the postwar car, the plywood body might be used in combination with 150-lb. aircraft-type motors and aircraft-type running gear to produce a sensationally lightweight car—possibly around 1000 pounds.

Russell's full-size experimental job is made of laminated, waterproofed, resin-bonded plywood—exactly the same material that has been developed for Army gliders and airplanes. For greater strength, he applies the plywood in two layers, one running fore and aft and the other diagonally, the layers being cemented together with waterproof bonding resin and riveted on all seams (above). (*Please turn to page 124*)

Scale model of an economical plywood body designed without a single compound curve. Because the plywood can be formed to these simple curves literally by hand, no dies or costly heat-setting processes are needed

Protecting textiles from silverfish

by C. L. MANTELL and E. MAY*

THIS paper deals with experiments done in cooperation with Professor H. L. Sweetman of the Department of Entomology at Massachusetts State College, Amherst, Mass., and the Technical Department of the United Merchants & Manufacturers Management Corporation. It has been found that silverfish will not attack unfinished goods where there are no finishes applied or present, or goods finished by a method which employs a modified urea-formaldehyde resin as a treatment on the fabric.

Throughout the South many complaints have been raised against fabric damage by silverfish. Manufacturers have suffered tremendous losses of fabrics in storage and warehouses. Consumers have found the insect eating book bindings, starched clothing, laces, window shades, carpets, and also attacking curtains and draperies hanging at windows, riddling them with holes.

Seneca Textile Corp. of New York City and Arkwright Corp. of Fall River, Mass., have been particularly interested in finding a finish for curtain material which would be uninviting to these insects. Several materials were submitted to the laboratory to test for silverfish reaction. In order to better understand the damage done by these insects it would be advisable to know something of their physical structure and living habits.

The silverfish has the biological name of *Lepisma saccharina* (L.). It is a glistening, silver-grey insect whose body is clothed with shining scales like that of a fish. It is variously known as "fishmoth," "silverfish," "silver witch," "sugar louse," "sugar fish" and "bustletail." A second species of silverfish, the *Thermobia domestica* Pack., is sometimes found in houses. It is known as the "firebrat" because it loves warmth and is usually found around fireplaces, chimneys and ovens. It can be recognized by the dark patches of color on its back, but is often mistaken for the common silverfish. It is thought that much of the damage attributed to the silverfish (*Lepisma saccharina* (L.)) has actually been the work of the firebrat.

Harvey L. Sweetman, Assistant Professor of Entomology, Massachusetts State College, describes the habitat of the silverfish and firebrat in his article titled "The Pest Thysanurans of New England," as follows:

"Silverfish are very sensitive to moisture and for that reason keep to the more moist portions of buildings, usually in the basement, on the ground floor, near the foundations, or around water and drain pipes where conditions may be moist. This does not mean that they will not make excursions for food to other portions of the house, but they spend the greater portion of their time near the moist areas. In midwinter, when heated buildings become dry, they are more restricted in their movements than in midsummer when conditions are more moist.

Silverfish can maintain themselves in warehouses and in storage rooms, if temperature conditions are suitable during the winter. This probably accounts for their accumulation in stored materials and subsequent transportation to various destinations. Apparently, they cannot maintain themselves in natural evironments, at least in temperate regions.

"The firebrat is very sensitive to temperature and is restricted by temperature more than moisture. Consequently firebrats are usually near the heating units, fireplaces, or heat pipes. However, moisture conditions are important also, and for that reason they may avoid hot portions of buildings because of dryness. Since they can withstand high temperature, feeding forays may be made to hot as well as cool portions of buildings. The firebrat is never found in natural environments; in fact, it is confined to buildings or places heated by man, at least in temperate regions."

Since we found it impossible to obtain any silverfish to carry on any experiments in the laboratory, Mr. Sweetman, whose article is quoted above, agreed to conduct the tests for us. Eight samples were sent to him. They are as follows:

Sample No 1: An all rayon material, white in color with a casein and resin finish, the resin not being of the urea-formaldehyde type.

Sample No. 2: This was an all rayon material, as described for sample No. 1, which was boiled in a 0.2 percent ammonium hydroxide and in a 0.1 percent solution of a synthetic detergent, so that all of the finish was removed as shown by chemical test which proved the absence of casein and of resin.

Sample No. 3: This sample was an all rayon fabric of eggshell color, treated with a resin of the urea-formaldehyde type and small amounts of casein.

Sample No. 4: This sample was a cotton and rayon marquisette with a starch finish. The sample had been dyed to an eggshell color.

Sample No. 5: A white cotton and rayon marquisette with a starch finish.

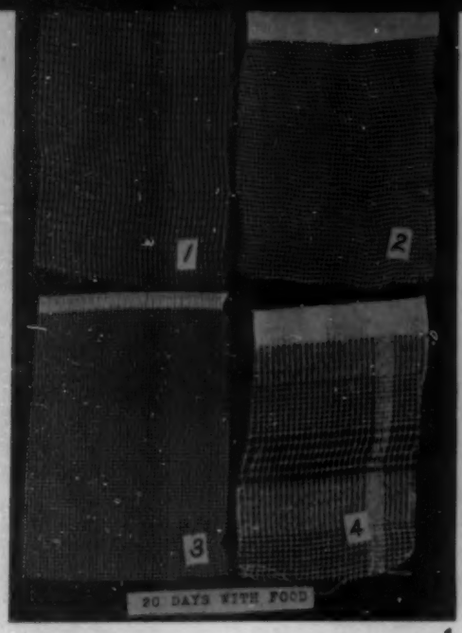
Sample No. 6: This sample was an all rayon marquisette, resin treated by a method which employs no casein, protein or starch. This finish is a modified urea-formaldehyde resin treated fabric which has been stretch set and calendered.

Sample No. 7: This sample is an all cotton grey goods which was treated with 2 percent rapidase to remove the starch. After treatment no starch was found.

Sample No. 8: This sample is the treated cotton of No. 7 which has been treated with Cooper's gelatin.

The procedure involved the use of large pans containing the eight samples of cloth, some of the pans containing other suitable food (whole wheat flour, brewer's yeast and dried lean beef), some, no other food except the cloth samples furnished. The temperature and relative humidity were kept under constant conditions, near the optimum for these insects. The tests were conducted in 20-, 40- and 60-day intervals. At the end of each interval photographs were taken of the eight

* Technical Department, United Merchants & Manufacturers Management Corp.



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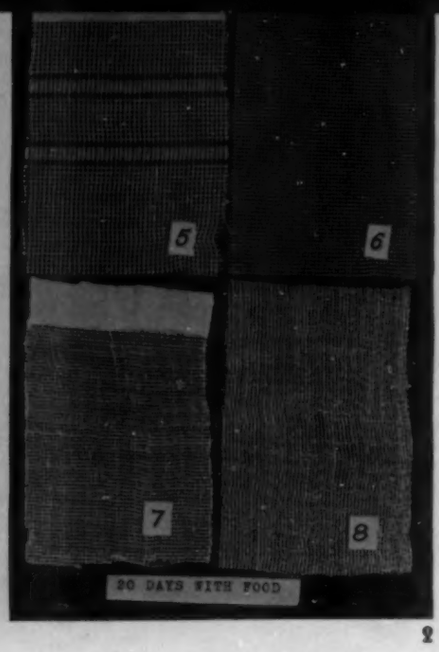

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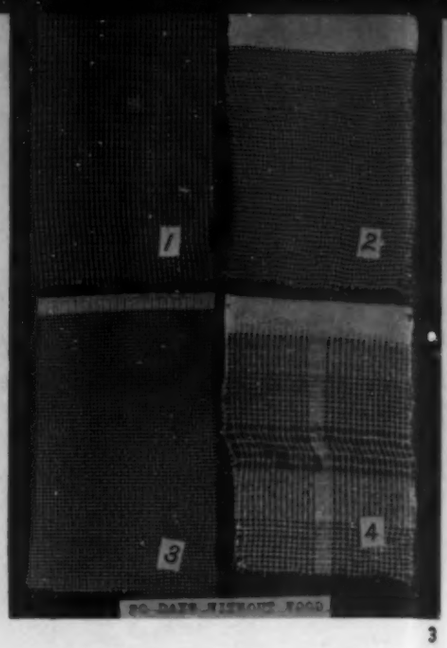

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samples in the pan and sent to us. Each of the three series is divided into two sections: the damage done in the pan lacking any other food than the samples and the damage done where other food was available. The results, as shown in the illustrations in this paper, were as follows:

TWENTY-DAY SERIES (*Figs. 1–4*)

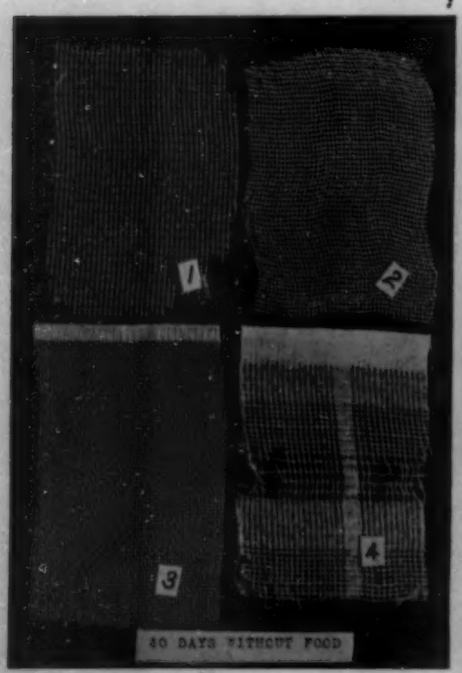
No.	*Sample*	*With food*	*Without food*
1	All rayon casein and resin treated	No damage	No damage
2	All rayon finish removed	No damage	No damage
3	All rayon resin treated plus casein	No damage	No damage
4	Cotton and rayon starch finish	No damage	Slightly damaged
5	Cotton and rayon starch finish	No damage	Partially damaged
6	All rayon treated Arkwright method	No damage	No damage
7	All cotton finish removed	No damage	No damage
8	All cotton treated with Cooper's glue	No damage	No damage

FORTY-DAY SERIES (*Figs. 5–8*)

Sample No.	*With food*	*Without food*
1	No damage	Slightly damaged
2	No damage	No damage
3	No damage	Two small bites
4	Slightly damaged	Partially damaged
5	Partially damaged	Severely damaged
6	No damage	No damage
7	No damage	No damage
8	No damage	No damage

After forty days, the samples Nos. 4 and 5 have been damaged. Sample No. 1 show slight damage in the pan without food and sample No. 3 has been sampled. Sample No. 3 was tasted, apparently because of its slight casein con-

7



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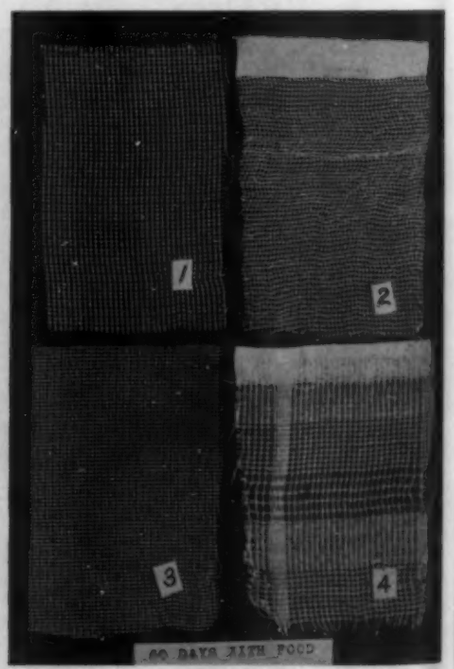

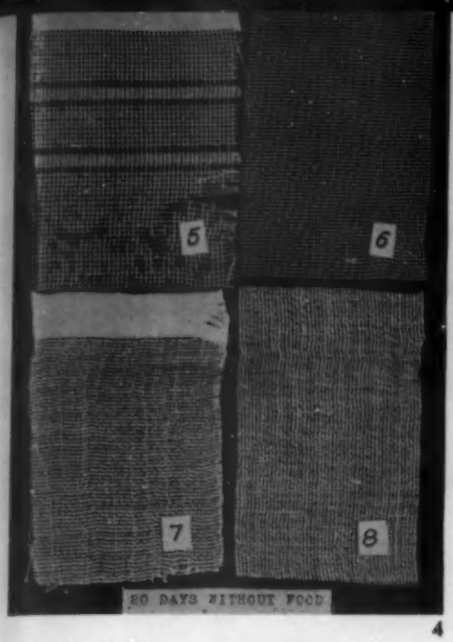

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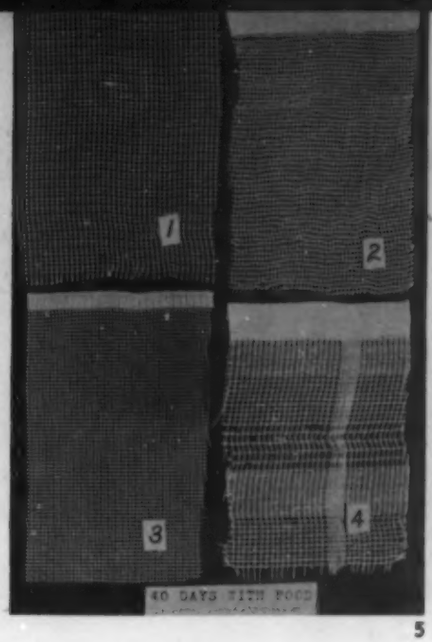

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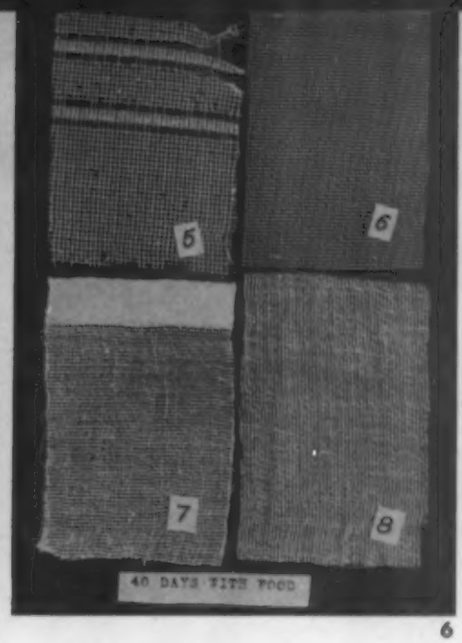

6

tent, but was rejected as food by the insects.

SIXTY-DAY SERIES (*Figs. 9–12*)

Sample No.	*With food*	*Without food*
1	No damage	Partially destroyed
2	No damage	No damage
3	One small bite	No damage
4	Slightly damaged	Severely damaged
5	Slightly damaged	Almost completely destroyed
6	No damage	No damage
7	No damage	No damage
8	No damage	No damage

Sample No. 1 remained untouched in the pan where other food was available, but where no other food was present silverfish partially destroyed the sample. The silverfish were attracted to this sample because of its casein content, but only when there was nothing else to eat.

Sample No. 2, which was all rayon with the finish removed, was not attacked during the course of the 20-, 40- or 60-day periods. This seems to indicate that the silverfish will not attack plain rayon but are interested only in the finish.

Sample No. 3 of all rayon construction with a finish containing urea-formaldehyde resin and a trace of casein was sampled by the silverfish in both the 40- and the 60-day periods.

Samples Nos. 4 and 5 consisted of cotton and rayon finished with starch. Both samples were severely damaged. It is apparent that the starch finish is attractive to these insects and they consumed it despite the fact that other food was present.

Sample No. 6, an all rayon marquisette finished by the urea-formaldehyde resin treatment, was not damaged in any way. At no time during the series was it even tasted. It was obviously uninviting to these insects.

Sample No. 7, all cotton with finish (*Please turn to page 120*)

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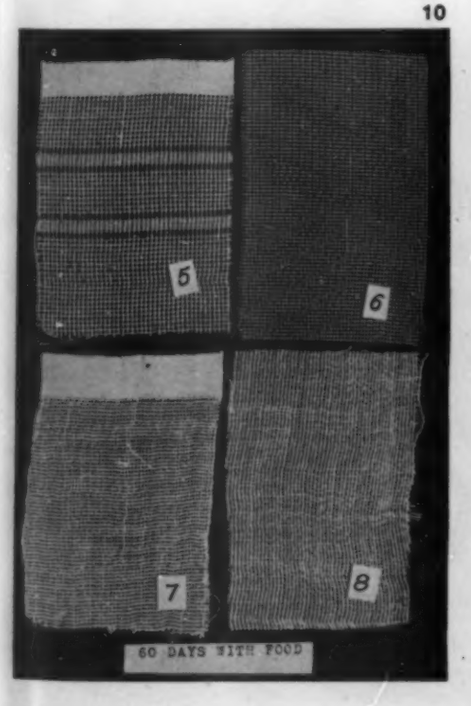

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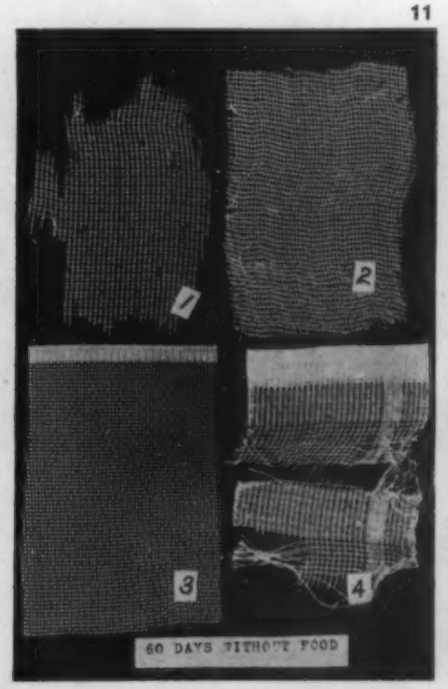

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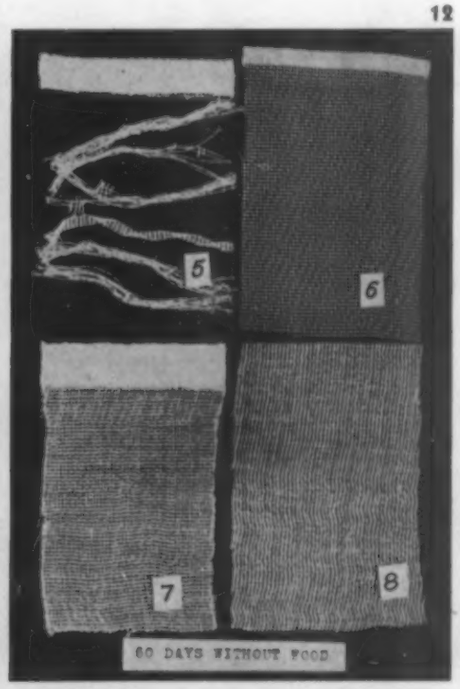


PRODUCT

Incendiary bomb fighter

Just one person is needed to roll out this sturdy, lightweight wood and plastic barrel—a fire-fighting tank pump recently perfected for emergency use. This pump-type extinguisher has its own 5-gal. storage tank, and since it is not a stirrup pump, the need for extra pails is eliminated. The tank pump (pump and wooden water bucket comprise a single unit) is 27 in. tall, weighs 10 pounds. Molded and extruded cellulose acetate butyrate parts help produce a pump said to have closer tolerance for piston fit than was possible with metal, and the plastic parts will withstand considerable rough treatment without breaking or deteriorating.

The plunger and the outer pump barrel are made from heavy-walled extruded cellulose acetate butyrate tubing with an overall outside diameter of 1¼ inches. Other plastic parts include the piston head, nozzle and valve assembly, all molded of the same material.

Clear cellulose acetate sheeting binds the synthetic hose through which a forced stream of water can be ejected an average distance of about 40 feet. The hose is made of water-repellent cotton-and-paper woven fabric base, with a spiral winding of the cellulosic sheeting which acts as a seal, covered with a special pitch-coated cable braiding which is fire-retardent.

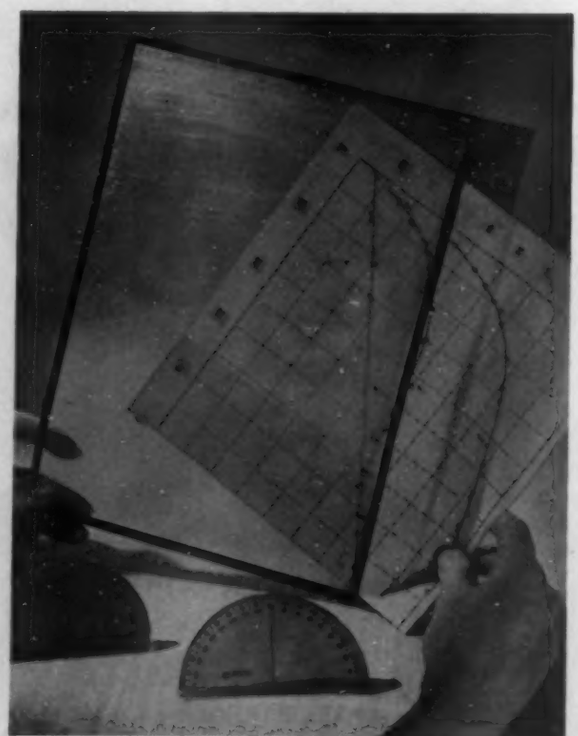
The apparatus is reported to have met laboratory tests for durability, to stand temperature varying from 15° below zero to 115° above. It is non-corrosive, which suggests its serviceability for postwar use as a whitewashing unit or for spraying trees and plants, since chemicals used for such purposes will not affect it.

Credits—Material: Tenite II, Kodapak sheeting. Tubing, Extruded Plastics, Inc. Molder, American Molded Products Co. Hose by National Electric Products Corp. Perfected by Plastics Products Engineering Co. for Columbia Mills, Inc.

Fluorescent envelope

The night of January 16, 1943, marked the renewal of the huge raids on the heart of the Axis—Berlin. Since these large-scale attacks have begun, the Allied air forces have learned much concerning the various physical factors which affect the functioning of the bombing crew. Night vision, or the adaptation of the eyes to cone vision in darkness, must be maintained throughout the raid if the crew is to operate efficiently. According to test reports, from 30 to 45 minutes are required to adapt the eyes completely to cone vision, yet a single flash of white light or ordinary light can destroy this adaptation in a second. Thus a bombardier attempting to check photographs of landmarks during the approach to an objective, must avoid the use of white light. Besides destroying his own visual adaptation, necessary if he has to man a gun or drop "eggs," he may by the use of visible light expose the crew to attack by fighter craft or ack-ack fire.

The solution to the problem of maintaining night vision with some flexibility for other duties is a transparent envelope of fluorescent treated plastic which reacts to near-ultraviolet (black) light. The orange-red plastic when exposed to a low intensity of unseen near-ultraviolet light produces a minimum light glow sufficient for vision of charts, maps, penciled messages, etc., inserted under the plastic surface. The envelopes, which can be made up in sizes ranging from small card holders to map cases, are used in conjunction with a portable near-ultraviolet lamp which can be placed on the navigator's table or which can be worn on the forehead like a miner's headlight. The lamp produces a cold light at the minimum usable level of intensity of cone vision, yet is sufficient to permit reading of a 36-sq.-in. area when placed 5 in. above the fluorescent surface and, since it has no visible beam, eliminates possibility of enemy observation. The same plastic material may be used for backing up the computator (lower right) used with the charts.



Credits—Material and lamp developed by J. M. Gordon.

DEVELOPMENT

Poultry fountain

Public interest in the lowly hen is on the increase these days, with the Government urging us to eat more chicken and less beef. Healthy poultry needs fresh, unpolluted drinking water, and trim bubble fountains to provide it are replacing the rusty tin pans of other days. One such waterer has recently been 100 percent converted from metal.

Both the drinking cup and the funnel which surrounds it are of heavy flint glass, double annealed for toughness and reinforced throughout for strength. Flexible tubing and fittings are of saran, while the valve body and bubble are machined from cast phenolic bar stock. Neither of these plastic materials is affected by water, age or sunlight, and both withstand acids, alkalies, high pressures and rough usage. Some slight difficulty was experienced with the fountain as first designed (see photograph): less mannerly birds, pushing and shoving around the flexible tubing at its bend near the valve, sometimes kinked or broke it. This hazard has been eliminated by developing an angle valve instead of a straight valve.

Mounted on an iron pipe or terra cotta drain 11 to 15 in. above ground or floor, the fountain provides drinking facilities for 150 birds, more than a dozen at a time. So constructed that rats can't pop up through the drain, it incorporates no perches (jumping is harmful to laying hens), and birds may drink with a minimum wetting of wattles.

The saran fittings exhibit little tendency to leak—a failing of metal fittings; while the pliability of the material makes it excellent for the handle (which has to be pressed into shape), and its flexural strength prevents the valve stem from being twisted off. For several months the fountain has been on display at the Farm Equipment Branch of WPB as a model of plastics replacement of metal.

Credits—Material: Saran, Catalin. Lipman Poultry Fountain designed and manufactured by Air-Tite Products Company.

Transparent lunch box

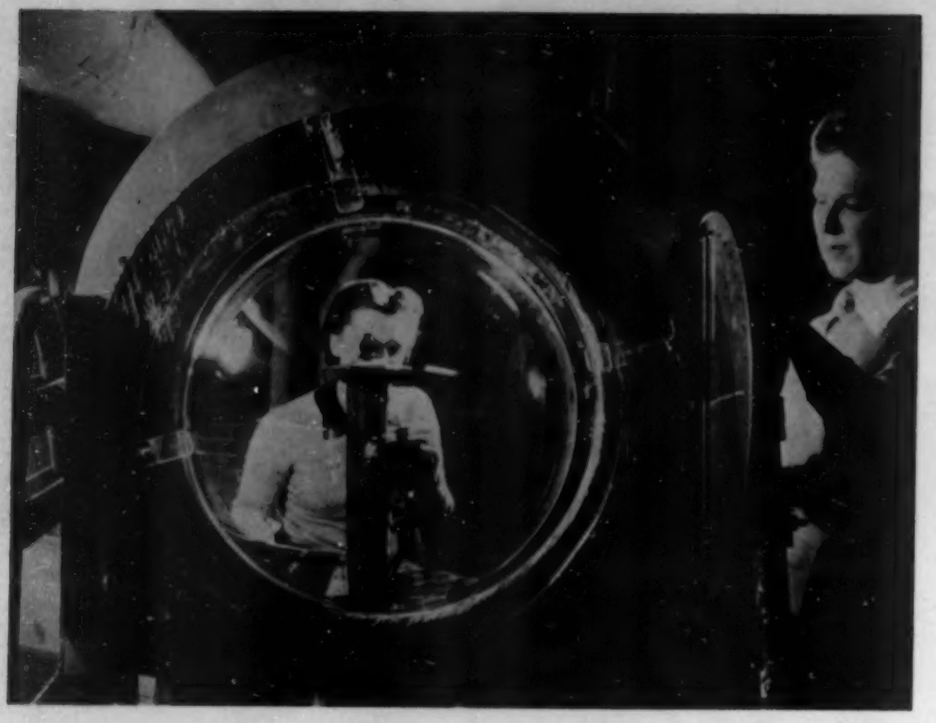
The war plant worker who objects to an inspector's pawing over his sandwiches, prodding his orange and poking speculative fingers into his wedge of pie will be cheered by this lunch box of transparent cellulose acetate. Although careful inspection of parcels carried in and out of industrial plants is necessary in time of war, the process takes the time of both inspector and worker and sometimes leaves tempers ruffled. A brief glance serves to check the contents of the newly developed plastic box, which is thus a saver of time, manpower and money—in addition, of course, to the metal which it replaces.

All you have to do to open the Victory Vu-Kit is press the little red balls which hold the end in place. There are no hinges or latches; and the only metal in the assembly—the rings which hold the thermos bottle in place—will probably be replaced before long. Even the handle is molded of cellulose acetate.

The sparkling plastic is lightweight, easy to keep clean, and won't dent or chip. Its resistance to outdoor exposure is excellent, and increasing age will not bring about discoloration of the material.

Fabricated from sheet stock, the box is less than 10 in. long and only 7 1/2 in. high, yet it will accommodate a pint thermos bottle, two hearty sandwiches, a piece of pie or cake and several pieces of fruit. A slot in the removable end provides a place for carrying the owner's identification card. The transparency of the material makes it simple for plant dietitians or welfare workers to tell whether employees are carrying balanced lunches, and enables them to make menu suggestions in an impersonal way.

Credits—Material: Lumarith, Fibestos. Lunch box designed and manufactured by V. W. Busch Mfg. Co.



Checking acrylic astro dome for accuracy. Girl inspector at left sights through transit, revolving dome horizontally, while second inspector turns dome through various vertical positions

Army astro domes

Precision optical instruments permit navigators on long-range bombers to get their bearings by accurate measurement

AMONG the unsung heroes of this war are the navigators on the Army's long-range bombers. Charting the plane's course to its objective, and checking its course at regular intervals, the navigator's job thus requires all the skill and training of a pilot or bombardier. But if he ever gets a medal, it will probably be for heroic work in his secondary job as side gunner—a rôle he must be prepared to fill if the bomber meets fighter opposition.

In the air, as at sea, the navigator gets his bearings by "shooting the stars" with a sextant. At sea, he simply stands out on deck; but outside a Flying Fortress flying six miles a minute at a five-mile altitude, he could hardly breathe, let alone take an accurate reading. Plastics, however, now provide complete protection for the navigator with a transparent material which offers practically no interference with his vision. The plastic is an acrylic resin, the same sturdy chemical product that encloses the bombardier, top turret and tail gunner, and other battle stations on the plane.

The acrylic material is actually clearer than plate glass, but less than half as heavy—in fact, it is lighter than magnesium. But it is strong enough to withstand the buffeting of sleet, rain and stormy air currents even when the temperature drops to 65° below zero in stratosphere altitudes.

Optical properties are important, of course, for the bomber's crew must see to fight. But the dome through which the navigator makes his observation is a precision optical instrument. Through this shallow dome—the Army calls it an astro dome—the navigator must measure the angle between the horizon and a known star to an accuracy of better than 1°. On a small scale, 1° is a deviation of only $10^1/_2$ in. in 50 ft.; on a terrestrial scale, 1° is a deviation of about 70 miles. Seventy miles off course spells certain failure to a bombing mission.

In the design, fabrication and inspection of these critical parts, therefore, the laws of optics must be obeyed to the letter. The shape of the part is a section of a sphere with the sextant so mounted that it is at or near the center of the sphere. Physicists can prove that the optical properties of a transparent part are best under these conditions.

For most aircraft applications, forming the acrylic is relatively simple. The material is hung in hot air ovens, heated slightly hotter than boiling water and laid across a wooden or plaster form. When it cools, it is trimmed to size with ordinary saws and is ready for installation in the plane.

However, the forming of the domes must be carried out to much closer optical tolerances. By an exclusive process developed in its laboratories, one plastics company alone is turning out the thousands of these parts required for our expanding bomber program. The sheets of acrylic are carefully selected, heated to exactly the ideal temperature and then formed under controlled cooling conditions within a certain time. On the basis of their experience to date, this company's engineers can predict the nature and extent of any optical distortion that is produced by variation of any one condition.

The inspection standards closely simulate the condition under which the domes will be used. An accurate surveyor's transit is focused so that its cross hairs cover the intersection of two black lines on a target fifty feet away; then the astro dome is mounted on a frame between the transit and the target. By electrical controls, a girl sitting at the transit can revolve the dome horizontally. (*Please turn to page 122*)

Keyboard for color

by EGBERT G. JACOBSON*

The Color Harmony Index was based on the research and books of Dr. Wilhelm Ostwald, for many years professor of physical chemistry at the University of Leipzig, great chemist, physicist, philosopher, historian—a kind of universal genius like Benjamin Franklin. In 1919, he was awarded the Nobel prize for his work in chemistry, which some have said revolutionized industrial chemistry. At the age of 56 he retired to devote the rest of his life to the study of color. In his autobiography he says that he regards this work as the most important of his life.

FOR one who must make color decisions, the important thing is to find pleasing combinations with the least possible effort and with confidence that others will also be agreeably affected. Such ability to choose should no longer be limited to a specially trained few, because the industrial use of color involves almost every kind of manufacture. Purchasing agents as well as shop superintendents, chemists as well as sales managers need to understand some fundamental color principles, and all require a common color language. These principles have freed designers and painters from the wastefulness of trial and error methods, and have added scientific accuracy to their creative powers.

To create color harmony it is necessary not only to know what you like, but also *why* you like it. If to this information you add a simple color language, you can describe any color to anyone who speaks this language, or writes it, or communicates with you by telephone or telegraph. And you can achieve precisely, instead of pretty nearly, the effect you seek without the intrusion of the fallible "human element."

When we decided to remeasure and produce the 680 Ostwald (see box) colors, we began to look for a practical way of making each individual one easy to locate. We turned naturally to plastics, for we needed tough material that could readily be adapted to our needs, and we hoped to develop a device that would be fairly attractive in appearance. We needed no new plastics, for no really new problems were presented. Indeed, we had a rather large choice among many excellent types already long in production. It may be interesting to see how a complete system of color chips can be suitably housed in six telephone indexes which form a kind of color harmony keyboard. But first let us agree on what we mean by color, color organization and color harmony.

We try to avoid the sensation of color disharmony in plastics, in furnishings, in printing and wherever we have a choice, just as we avoid disharmony of sounds, which we call discord. Because both sound and color are sensations, we may compare methods of arranging the stimuli that produce these sensations.

When you are writing notes in some kind of orderly sequence, you have much the same problem that the artist has who is painting one color next to another—you are searching for ways to create harmony. If all the tones that can be drawn from a piano could be suspended in mid-air, you would be constrained to arrange them again in some order, such as a series of octaves, before you could readily find those which would produce harmony. This kind of arrangement was first completely adopted by Bach so long ago that we hardly stop to think what an important step forward in music it was. Anyone who will take the trouble to learn the position of the tones on the piano can learn to produce harmonious chords. But if these tones were continuously rescrambled, without any known and permanent relationship (in terms of sound frequencies), not even a musical genius could find his way among them.

Now the analogy between sound and color is accidental; indeed, it cannot be carried any farther than the comparison between any other two sensations such as the taste of a lemon and the feel of sandpaper. You hear music and you see color; the ears are stimulated by sound waves and the eyes by light waves. But we may reason that a color "keyboard" will be as useful as a musical keyboard if we can make one in which the colors, like the tones of a piano, are definitely established and are always in the same position with respect to one another. The 680 surface colors in the Ostwald arrangement do not include, of course, all the possible color modifications. His arrangement, however, provides an adequate range of colors whose relationships are known in terms of light measurement. It is in this respect that the color standards may be compared to the tuned piano keyboard.

(*Please turn to next page*)

* Art Director, Container Corp. of America.

1–4—*Diagrams representing graphically the various scales for color relationships of the achromatic colors and the variables of the chromatic colors as described above*

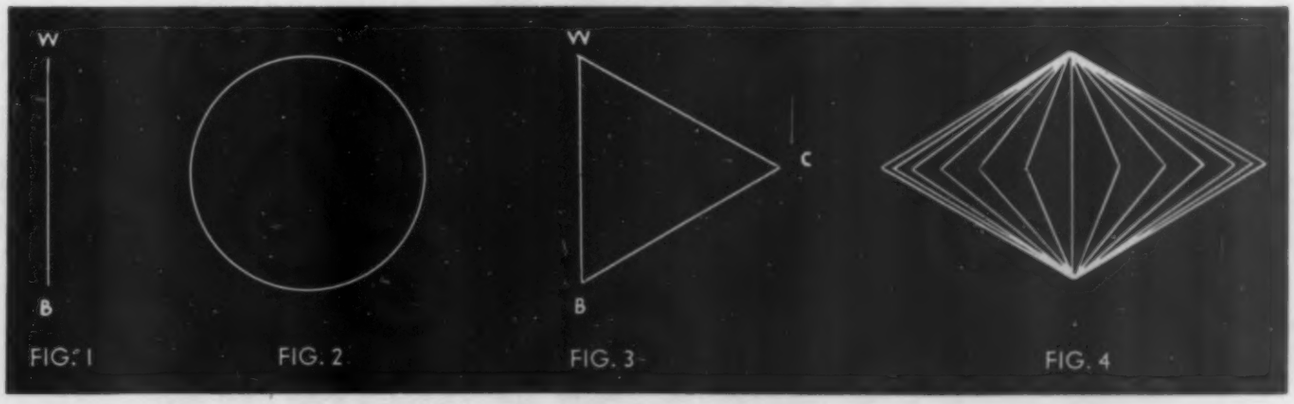
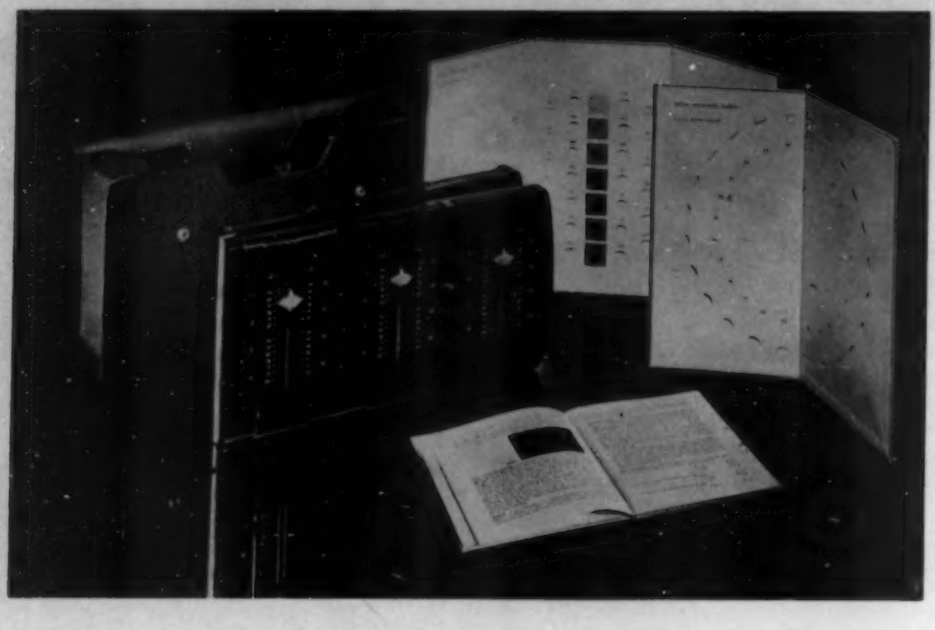


FIG. 1 FIG. 2 FIG. 3 FIG. 4



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5—Folded Color Harmony Index, text and charts—all fit neatly into the open leather case. 6—Six compartments, housed in a molded plastic index case, open to any color by the push of a button. Removable color chips are of cellulose acetate base, one side pigmented film sprayed

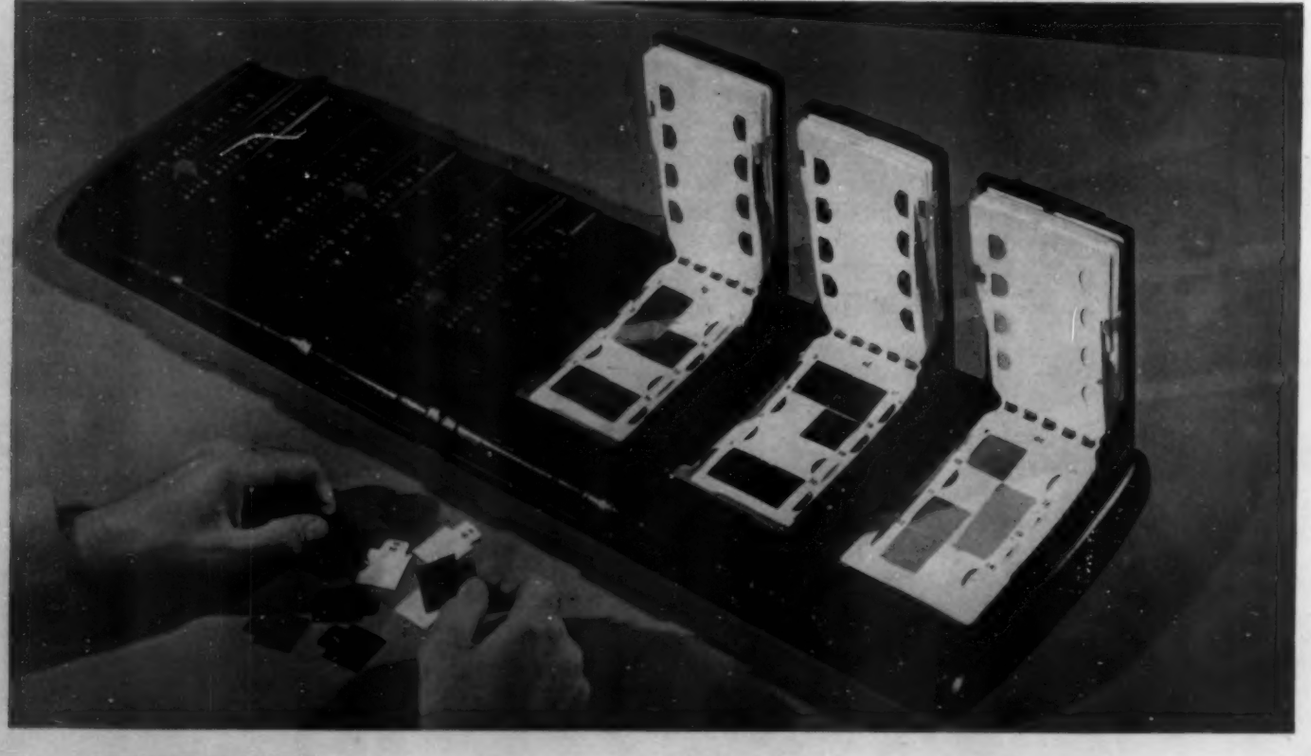
The piano keyboard does not contain all the possible tone sensations, but those it includes have a measured relationship to one another in terms of sound frequencies.

Furthermore, a color keyboard should enable us to discover color harmonies, because harmony is a matter of measured and easily perceived relationships whether in music (sound relationships), or color (light reflectance relationships). When these are pleasing experiences, it is largely because of their measured character. A brief and wonderful definition of harmony was set forth in three words by Dr. Ostwald: "Harmony equals order." In the Color Harmony Index the colors are arranged in an orderly manner (according to known relationships) for instant selection. These relationships are based in part on the distinction Ostwald made between the *achromatic* and the *chromatic* surface colors.

The *achromatic* colors are those in a straight line series from white to black. That is to say, they form a scale of measured grays with regularly diminishing white content so that adjacent steps seem perceptually equal. This scale has only one variable, white, for in it the colors have no chromatic quality whatever. We represent them by the line *WB* (Fig. 1).

All other chromatic sensations have three variables. The first is *hue* content: yellowness, blueness, redness and greenness. The second is *white* content, and the third is *black* content. The variation in hue is most conveniently represented by a circle, because if we begin with yellow, for example, we pass naturally to orange, to red, to violet, to blue, to blue-green, to yellow-green and to yellow again. Thus we have the hue circle, Fig. 2. (*Please turn to page 118*)

6



Mopping up with thermoplastics

IN the past twelvemonth, abrupt and startling changes have overtaken many a comfortable, well-run American household. Once-purring radiators are chilly to the touch and unused rooms, shut off like pariahs, are dank and forbidding. The car seldom pushes its bonnet beyond the garage door—if it hasn't been put in dead storage. The pantry looks a little like Old Mother Hubbard's cupboard, and the exciting smell of broiling steak rarely comes from the kitchen stove. No array of new silk frocks crams the clothes closets and neat piles of Nylons are missing from bureau drawers. Hands long accustomed to holding bridge cards of an afternoon are now clutching mops.

The matron who hasn't touched a cleaning appliance for years is discovering that running a mop around the floor isn't such hard work after all, chiefly because mops have changed a lot since the day when she gave one a last, reluctant shove. The heavy, unwieldy object of the past, usually colored a dreary, uncongenial gray, has given place to a light, neatly fashioned implement with frame and socket of colored plastic.

In 1940, after Great Britain and the Dominions had been at war for a year, O-Cedar of Canada, Ltd., began to experience a tightening up of the steel sheets and rods which went to make up the frames and sockets of their mops. Sheets were more difficult to obtain than rods, and the company went to work on the development of a rubber socket, which was put on the market early in 1941. So superior did this new socket seem to its steel predecessor that the firm began to think in terms of an equally flexible material for the mop frame as well. Spring steel being definitely out of the question, the field of plastics was surveyed. Several plastic materials were tried out and cellulose acetate butyrate was selected for the rod of the company's oval slip-on mop (see Fig. 2), already equipped with a rubber socket. Customer and consumer alike were so well pleased with the mop's flexible, lightweight plastic frame that the company decided to carry its researches further and develop frames and sockets of plastic for its entire line of mops.

The three types of plastic frame and socket which now attach mop to pole are shown in Fig. 1. At the upper left is the triangular slip-on; at its right, the de luxe mit-mop; and, below, the oval reversible slip-on, or Victory mop. All three varieties are being molded by an American firm for consumption this side of the border, while one Canadian molding company produces the triangular frame and its socket and another supplies the round rods for the other two types. The sockets for the latter are molded by the U. S. company.

For the triangular frame, a 2-cavity injection mold is used, and for its socket one with 4 cavities. After they have been molded, the two parts are fastened together by a small metal rivet. Both clear and opaque butyrate are employed and the parts come in colors, which adds to the appearance of the assembled mop. The $^{3}/_{8}$-in. diameter rod for the mit-mop and Victory mop is extruded and bent to shape after the socket has been slipped on, and the frame's curves keep the latter from sliding out of place. Sockets for the two round-rod mops are handled in a 4-cavity injection mold, running on a 4-oz. press.

Pads for Victory and triangular mops slide over their flexible plastic frames like curtains on a rod, and their ends are tied together with short lengths of tape. As its name implies, the mit-mop pad slips over the frame like an overstuffed glove. Molded-in threads permit the mop poles to screw tightly into the sockets. (*Please turn to page 128*)

PHOTOS, COURTESY O-CEDAR OF CANADA, LTD.

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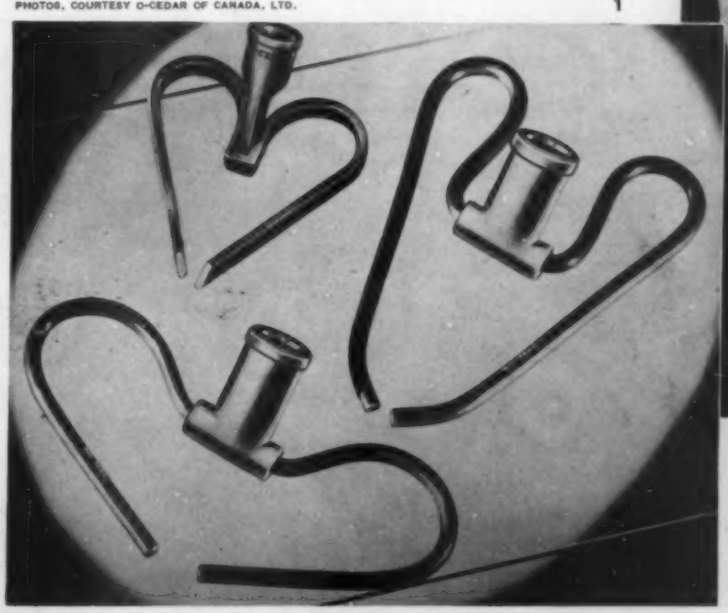

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1—*Three types of plastic mop frame and socket: left, triangular slip-on; right, mit-mop; below, oval reversible slip-on. Rods are extruded and all other parts are injection molded of cellulose acetate butyrate.* **2**—*Mop pads slip over rods, may be removed for washing*

PLASTICS IN REVIEW

1

2

1 A white plastic covering for metal seat supports adds to the appearance of the up-to-date bathroom and is easy to keep clean and free of germs. Sperzo Modern Seat Co. uses 1/2-in. tubing of Ethocel, extruded by Detroit Macoid Corp. in 3 1/2-in. wall thickness. Tubing is shipped in cut lengths, and simply slipped over the metal supports during the assembly of the seats

2 Sink stoppers are always in hot water, and have to get used to it! These of heat-tough Lumarith based on Hercules cellulose acetate are molded by Kampa Mfg. Co. in a variety of sizes. Lightweight and flexible, the plastic stoppers are mechanically strong, and won't be affected by the unsavory elements in dishwater

3

3 Both the large phenolic switch base and the tiny but no less intricate one were formed in single-cavity molds. The big fellow measures 22 by 8 1/4 in. and weighs (with cover) over 12 pounds. High dielectric strength and durability of this plastic have won for it continued recognition in the field of electrical equipment. Both of these pieces molded of Bakelite by American Insulator Corp. for Westinghouse Electric & Mfg. Company

4 A small but successful copper replacement is the plastic collar which adorns an oilstone used for sharpening edge tools. Molded of Durez for H. W. Busler, the collar is integral with the metal chuck rod. Color chosen in this instance is red, but if advantage is taken of the variety of colors in which the plastic is available, a workman will soon learn to recognize his tool by the color of its collar

5 For the unfortunate who "has something in his eye": the Mag-Optin, an ingenious device for locating the particle and a magnetized wire for loosening and removing it. The unit is injection molded in two parts of transparent Tenite by Cincinnati Advertising Products Co. for Allergy and Medical Products Co. The hollow base of the plastic lens fits snugly over the handle, which holds the wire and the tiny magnet which activates it

6 A group of fluorescent tube sockets incorporates a spring-hinge lock principle to avoid vibration breakage. As one prong of the tube is inserted into the slotted holder, the tube is turned slightly and the other snaps into place, locking the tube

4

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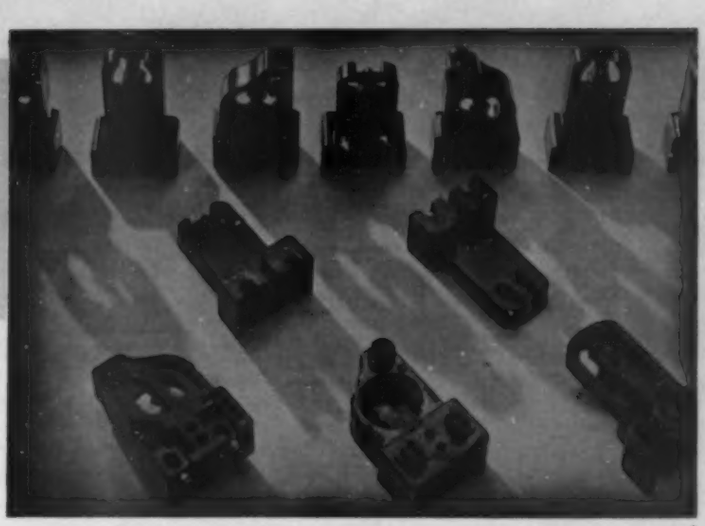

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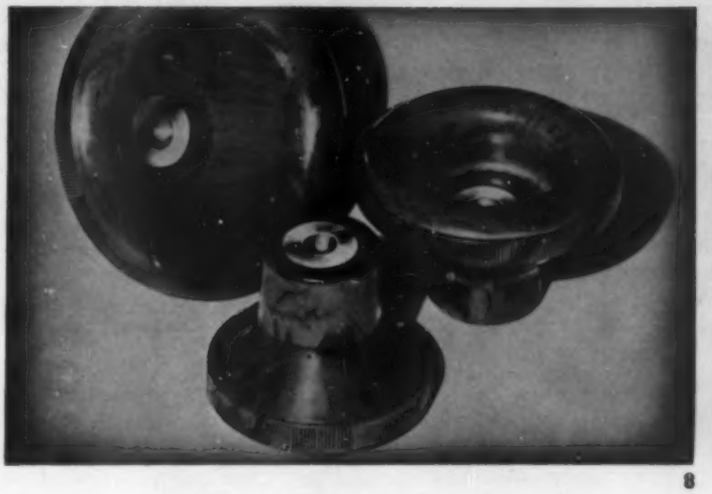

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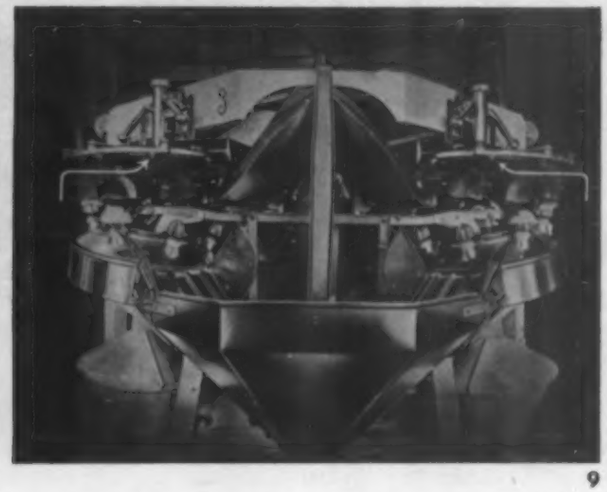

9

into position. Waterbury Button Co. molds the new sockets of self-insulating Durez for Kulka Electric Mfg. Co. No finishing of the sockets is required except removal of flash and fin

7 Recipients of samples don't toss them into wastebaskets if they are molded into blocks of transparent Crystalite, a technique developed by Adolph Buehler Co. The transparent plastic protects the product from corrosion or scratching, allows it to be labelled easily and prevents it from being lost. The light-transmitting qualities of the material make it an ideal medium for displaying samples. Naturally, products eligible for this type of distribution must be able to withstand molding temperatures and pressures

8 Makers of machine tools can conserve metals and reduce their tool costs by replacing the metal in handles and control knobs by cast phenolics. This group has been fabricated from Catalin rod stock. Their impact strength is unusually high, and they are unaffected by machine oil and grease.

9 Methyl methacrylate bearings on great rotary juice extractors like this one thrive on the contact with citrus juice and hot steam which was so detrimental to their bronze predecessors. In anticipation of a shortage of bronze, Brown Citrus Machinery Co. experimented with bearings fabricated of Lucite, found them to have exceptionally long industrial lives, and to be equally unaffected by the juice of the orange, the lemon and the grapefruit

10 U. S. Plywood engineers designed in molded Weldwood this cover plate for a Diesel engine. Slated to replace aluminum, of which it represents a 52-lb. saving, the cover is composed of birch veneers impregnated with phenolic resin. It is said to withstand oil spray at 190° F.

10

Wartime conference in Toronto

AT a special wartime conference of the Canadian Section of SPI held at the Royal York Hotel, Toronto, Canada, on January 19, 1943, A. E. Bryne, manager of the Plastics Section, Canadian General Electric Co., Ltd., was elected unanimously to the post of chairman of the Canadian Section. K. H. Braithwaite, chief engineer, Duplate, Canada, Ltd., was elected vice-chairman, and L. J. Falkenhagen, sales manager, Jos. Stokes Rubber Co., was named secretary.

More than 250 molders, laminators, fabricators and material manufacturers from both sides of the border attended the day-long conference, which emphasized the rôle of plastics in the output of war matériel.

Featured speaker at the closing banquet session of the conference was E. T. Sterne, Controller of Chemicals, Department of Munitions and Supply of the Canadian Government. Mr. Sterne emphasized the need for more and still more production from the plastics industry for war purposes, and said this could be done only through intelligent "cooperative competition."

The Canadian Controller said that this was not a paradoxical phrase but rather a precise definition of the needs of the moment. The idea he said, was to get a unity through cooperation and at the same time maintain competition so that the unity would not lead to a uniformity of thought and action which would be harmful. Unity meant, he stated, merely a cooperation which brought out clearly the main objective in view. It did not mean, said Mr. Sterne, a method of achieving universal conformity to set patterns and methods of doing business.

"You of the plastic industry," Mr. Sterne concluded, "have a great challenge—the challenge of production. So far you have met that challenge marvelously well. But you are just at the opening of the arch. Through a cooperative and friendly spirit, stimulated with the competitive urge to reach the common objective before the other fellow, you have a great instrument to do a great job. You must pool brains. This does not mean that one 'cooperator' should swallow up one or several of his fellow 'cooperators.' It simply means that you face the test of greatness—the measure of your greatness being the amount which individually and collectively you contribute to the production picture."

Captain E. T. McBride, Special Counsel, Technical Division, Office of Ordnance, United States Army, revealed the planning and engineering done by the Ordnance Office in bringing plastics into the picture for ordnance requirements.

"In most cases," he said, "plastics have been adopted for standard components to relieve critical materials such as brass and aluminum, and in many cases standard components required redesign. In the prewar days, for example, certain fuze parts were designed and machined from bar aluminum. In developing plastic fuze parts, the tendency was to convert the aluminum parts directly to thermosetting plastic, which is capable of standing rotational spin, temperature and humidity. As the development progressed, it was found that the design created for aluminum bar stock was not adequate or economical as a molded plastic part. For this reason, Ordnance engineers have effected redesigns which result in improved components, savings in production costs and raw materials."

Capt. McBride then explained briefly the organization of the Ordnance Department to enable his listeners to understand its functions with respect to conservation and plastic usage in ordnance.

After roughing in this picture of Ordnance Dept. functions, Capt. McBride told of the temperature range which molded plastic components must withstand (from −40° to +170° F.). Until recently, he said, only thermosetting materials have shown the physical properties necessary for ordnance material. But he revealed that recent tests have shown certain formulations of cellulose acetate butyrate containing an ultraviolet light inhibiting compound are capable of successfully resisting the weathering effects of a 500-hour accelerated aging test, the equivalent of 5 years' weathering in the field. In addition to resisting weather and temperature without ill effects, he added, it is necessary for molded plastics not to lose their plasticizers or to undergo a serious change of mechanical properties or dimensional stability at extreme arctic and tropical temperatures.

"Thermoplastic materials in general are usually unsatisfactory for Ordnance applications due to their inability to maintain dimensional stability at extremely high and low temperatures, and to resist grease and oils. Due to the shortage of phenolic materials," the Captain said, "it has become necessary to use a thermoplastic in those applications where dimensional stability is of less importance. It is necessary, however, to standardize the material which comes closest to phenolic specifications, and which is available. After exhaustive tests, cellulose acetate butyrate was selected as that compound which most nearly approximated the results obtained in the utilization of phenolic compounds.

"The Army Ordnance Department accordingly published a tentative specification for molded thermoplastic for small arms components, which is known as AXS-776. The material approved consists of a suitable cellulose acetate butyrate formulation containing an ultraviolet light inhibitor and possessing no disagreeable odor. The specification provides for testing at both −40° F. and +170° F., the pieces being conditioned at these temperatures for 4 hours before testing. Although originally intended for small arms contracts, AXS-776 has been used by other operating branches of the Ordnance Department.

"In addition to laboratory tests, plastic compounds and applications, both standard and experimental, are given extensive service tests in the field. These tests tend to show the errors of design and the shortcomings of material from which the components were fabricated. Tests are conducted at various temperatures and under various weather conditions. The parts are subjected to the rough usage common to warfare, and are often tested to destruction, the life of the plastic component being compared with that of the standard component.

"At the present time, materials and plastic Ordnance applications are undergoing tests at a winter proving ground. The plastic materials which will be considered consist of the four phenolic compounds listed in AXS-815, lignin modified phenolic, cellulose acetate, cellulose acetate butyrate and ethyl cellulose. The molded samples are panels measuring $8 \times 10 \times 1/8$ in. and will be exposed to the weather on a test fence in order to determine the comparative effect of sub-zero temperatures on the various materials with respect to dimensional stability, change in weight and general appearance. The materials will not only be tested for their ability to withstand arctic weather conditions in the as-received condition, but will also be tested with grease and oil to determine the effect of lubricants on plastic compounds at low temperatures. Specimens will be accurately weighed and dimensions measured across both length and width. The thickness will be measured at two places. These dimensions will be checked at frequent intervals and at the termination of tests, percentage change in weight and change in dimensions will be calculated. The materials will then be evaluated for their ability to withstand arctic weather conditions. Following their exposure at the winter proving ground, those materials which have successfully completed the test will be subjected to similar tests at a desert proving ground to determine their relative ability to withstand elevated temperatures and humidity."

"Plastics are by no means a cure-all," (*Please turn to page 134*)

Plastics ENGINEERING
F. B. STANLEY, Engineering Editor

Molded parts for civilian gas mask

WHEN the civilian gas mask was designed, one problem to be solved concerned a positive and leak-proof method for attaching the outlet valve and the canister to the facepiece. The canister attaches directly to the front of the facepiece, and the outlet valve is on the left side, as shown in Fig. 1. In an effort to find the most suitable and practical way to attach the outlet valve, a midwestern metal stamping company was called upon for engineering consulation. This company has had years of experience in the engineering and manufacture of similar fastening devices for all types of industrial products.

Fastening devices

It was first suggested that a round speed nut be designed to snap over a plastic collar on the underside of the outlet valve in such a way that the speed nut prongs would grip the plastic collar to hold the valve securely in place. Experimental samples were made and the speed nuts held the valve securely in place with sufficient uniform pressure against the facepiece to prevent any leakage.

These assembled samples were then given a series of "tropical" tests to determine whether the attachment would be equally satisfactory in tropical climates. It was found that in temperatures of 120° to 130° F., the cold flow of the thermoplastic material under the pressure of the spring-steel speed nut eventually caused the assembly to loosen. It was then suggested that a hardened steel reinforcing ferrule be made to conform to the same shape as the base and collar of the plastic valve.

This ferrule would then be used as an insert and be molded directly into the lower portion of the outlet valve. In this manner there would be no pressure on the plastic because the spring-steel speed nut would grip the shank of the steel ferrule. Figure 2 shows the front and back view of this ferrule as well as views of the outlet valve with the ferrule molded in place. Note the sheared-out tabs on the ferrule which serve as a means of anchoring into the plastic. In this same illustration is shown the round speed nut. Note the 12 integral prongs on the speed nut, 6 formed downward to bear against the facepiece and 6 formed upward to bear against the underside of the curl in the collar of the ferrule. Both the speed nuts and the ferrules are made on progressive dies mounted in high-speed automatic presses. Complete coils of high-carbon spring steel are automatically fed into these dies. The completed parts are then heat treated and Parkerized, after which they go through a linseed oil dip. This protective finish withstands corrosion much longer than the 20 hours called for by the salt spray test which is specified by the Chemical Warfare Service. (*Please turn to next page*)

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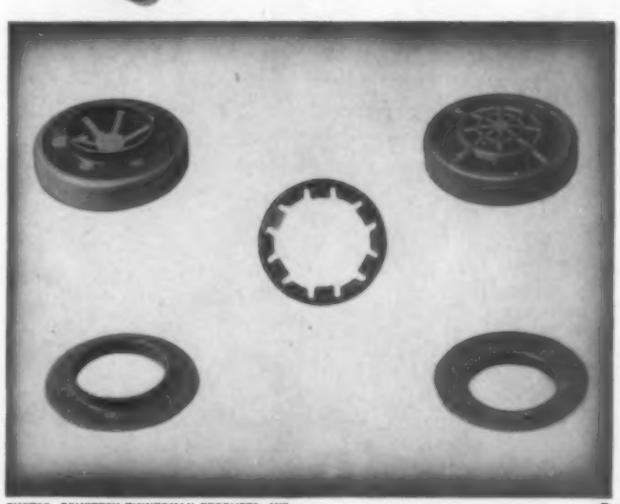

PHOTOS, COURTESY TINNERMAN PRODUCTS, INC. 2

1—Civilian mask showing canister attached to facepiece by spring steel clip, molded outlet valve and guard, plastic lenses. **2**—*Parts of valve and guard: above, left, valve with molded-in insert and, right, guard assembled to valve; center, speed nut for permanently tight assembly of valve to facepiece; at bottom, steel ferrule inserts*

Another problem to confront this company was a method for the attachment of the canister to the facepiece. Formerly two pieces of wire were used, spaced about $1/2$ in. apart on the outside of the facepiece, and fastened by twisting the wires with pliers. An adhesive tape was then placed over the wires to cover the sharp ends and provide an additional seal. This method of fastening was not positive enough, and the operations were slow, tedious and expensive.

The company designed a circular clamp of spring steel that could be latched almost instantly and that accommodated a range of diameters to compensate for any variation in the canisters or in the thickness of the facepiece. This clamp, illustrated in Fig. 1, has two embossed annular ribs close to either edge of the clamp which grip into the facepiece, making a perfect seal. The latching means consists of a T-shaped latching finger on one end of the clamp which engages saw-tooth-shaped prongs on the other end.

In order to manufacture these clamps at high speed, this company designed and built special machinery for the job. One unit of this special equipment is shown in Fig. 3. Coiled strip steel is fed through an automatic feeding mechanism into a die in a large press shown at the left of the photograph where all of the punching, shearing and forming of the latching mechanism is done in a two-station die. As the stock leaves the die, it passes through a channel about 10 ft. long, is then turned 90° to a vertical position and enters a special bending machine shown at the right of this same photograph. This bending machine resembles a giant 4-slide, except that the cut-off and forming tools are actuated by air cylinders. By special timing equipment the bending machine is exactly synchronized with the press and as the stock enters, it is cut to exact length.

The special relays for this timing equipment are shown mounted on a panel between the punch press and the bending machine. After the clamp is cut, the forming tools do the bending operation and the completed clamp is dropped from the machine. Great care was necessary in the design of this precision timing and feed mechanism in order to enable the strip stock to enter the press for the first operations, then progress to a bending machine 10 ft. away and be cut off and formed to the rigid tolerances which were specified. These clamps, after being given two coats of gray backing enamel, are then shipped to the various gas-mask assembly plants located at strategic points in the U. S.

PHOTO, COURTESY TINNERMANN PRODUCTS CO., INC.

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The molded parts

The inserts (speed nut and ferrule) are shipped to the various plastics molders who hold contracts from the Chemical Warfare Service for molding the three plastic parts on this job; namely, the body or valve part, the valve guard, and a separately molded pin which is used with the assembly of the highly important rubber sealing valve.

The tools manufactured by one molder for the production on this job are as follows: one 12-cavity injection mold (Fig. 4) for the valve, one 12-cavity injection mold for the guard (Fig. 5) and a 30-cavity mold for the pin.

The molding of the valve itself is an interesting job. This 12-cavity mold is run in a standard 8-oz. injection machine and the production is approximately 450 heats in 8 hours. This production is made possible by two important factors, one being that there are two sets of force plates, which permits one set of plates to be used in the molding operation while the second set of plates is on the bench. Another reason

3—One unit of the special machinery designed and built to completely punch and form the circular spring steel clamp used for assembling canister to facepiece. 4—A 12-cavity injection mold used for the gas mask valve. 5—Same type of mold is employed for the valve guard

PHOTOS, COURTESY IDEAL NOVELTY AND TOY CO.

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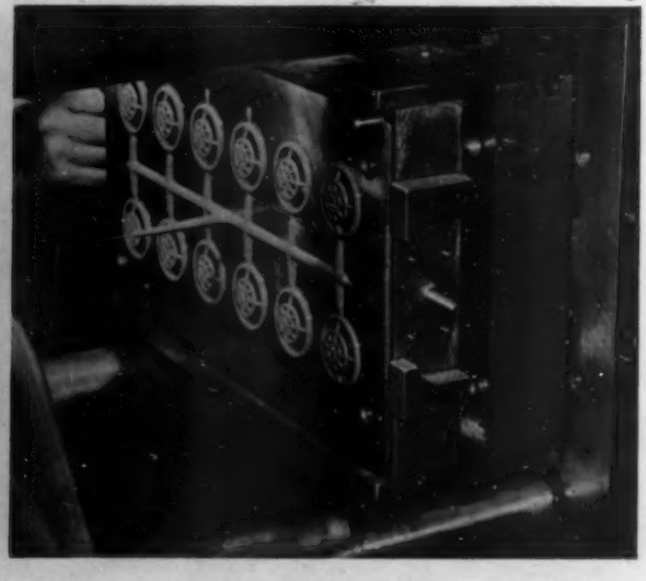

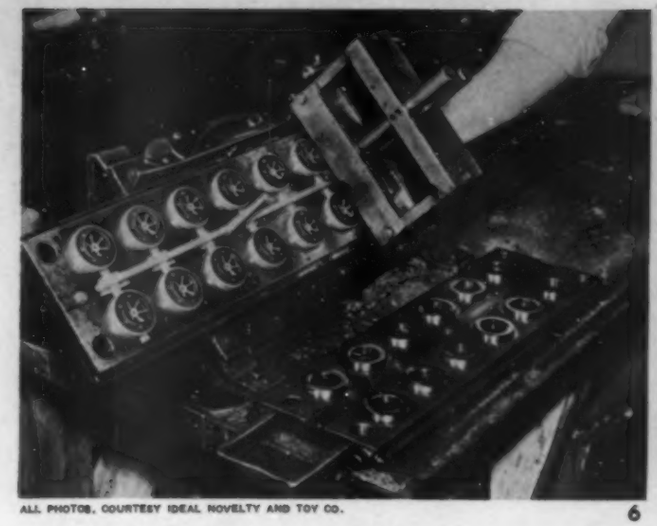

ALL PHOTOS, COURTESY IDEAL NOVELTY AND TOY CO.

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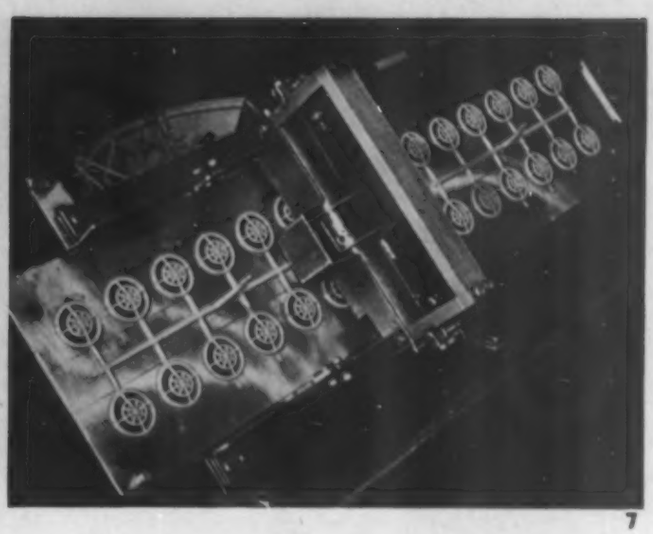

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6—Unique fixture for cutting the gates of plastic outlet valves. *7—A similar gate-cutting device is used for valve guards.* *8—This machine assembles molded pin into body of valve.* *9—Complete set-up for assembly of the outlet valve, including its gaging, inspection and packing*

for this high production is that a unique gate-cutting fixture (Fig. 6) was designed to reduce the time of this operation to a minimum, it being necessary, of course, to cut the gates fairly close to the body of the parts before these parts can be unscrewed from the threaded plugs.

A brief description of the gate-cutting device is as follows: the force plate with the 12 bodies and all sprues and runners intact is laid on a track in a horizontal position. This track is so constructed as to permit the force plate to slide freely. Mounted above this track in such a position that they will engage with the gates at a point close to the molded part are two sharp knives held in a fixed position by a framework which is secured to the track. The operation is as follows: as the force plate is slid along the track, the knives engage with the gates and make a clean cut, thus permitting the valves to be unscrewed from the threaded plugs. This operation is done very quickly, as the molder's helper merely sets the plate on the track, grasps a handle on the front of the plate and with one yank pulls the force plate under the knives, and then lifts the gate and runners in one piece from the force plate. The valves are then ready for unscrewing.

Two unscrewing fixtures are mounted with pinion gears which are engaged by another gear mounted on a rotating shaft. This shaft, in turn, is fastened to a crank. The unscrewing assembly is then placed over two bodies at a time. The crank is turned and the parts, quickly unscrewed from the threaded plugs, drop into a production box. The fixture is then moved down to the next pair of valve bodies where the operation is repeated. This operation is also very fast, and at no time does the bench time of the force plate slow down the molding cycle. The complete cycle of this job was timed at about 60 seconds. At the time this study was made, it was admitted that there was room for improvement in the cycle as a great deal of time was being taken loading the 12 inserts in the cavities of the mold by hand. A loading fixture is now being constructed to speed up this operation and should save from 10 to 15 sec. per cycle.

In the use of this loading fixture the molder's helper will assemble the 12 inserts into the fixture and when the mold is

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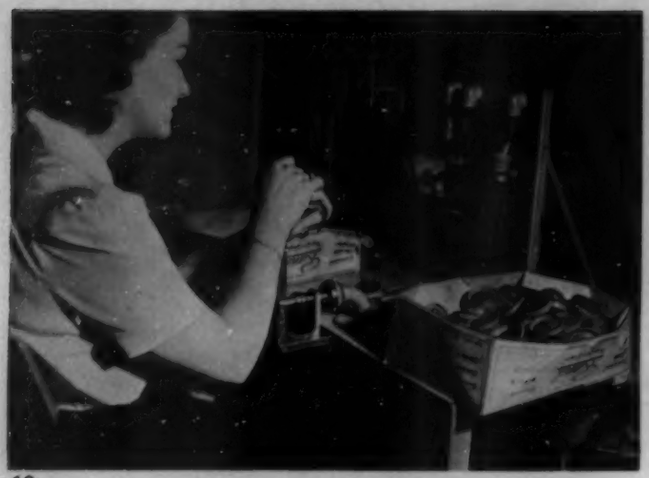

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opened, one quick operation will suffice to transfer these inserts from the molding fixture to the cavities of the mold.

In Fig. 16, which is a drawing of the valve or body, the sealing surface is indicated by "A." In the operation of this valve the sealing surface is the most important part of the molded piece, because this surface must be smooth, flat and uniform to permit the outside periphery of the rubber valve, indicated by "C," to make an air-tight seal against this molded surface. A great amount of difficulty was experienced by all of the contractors on this job due to sink marks appearing on this highly important surface, thereby causing the part to be rejected. This molder, after much experimentation, finally increased the thickness of the gates to approximately .150 in., and from that time on all difficulties of this nature were eliminated. This point of heavy gates should be given careful consideration by all tool designers, especially when

10—*Testing equipment for checking leakage in valve.* **11**—*Assembly of rubber valve to plastic valve is a hand operation.* **12**—*The first hand operation in assembling outlet valve to facepiece is forcing ferrule through hole in facepiece.* **13**—*Final assembly operation, in which speed nut is snapped over collar of ferrule, locking outlet valve in place.* **14**—*Facepiece turned inside out to show speed nut and valve assembly.* **15**—*Test equipment for checking leakage between facepiece and valve*

15

the molded part has its wall sections of varying thicknesses.

Figure 7 shows, in the threaded plates of the mold, the molded guard whose main function is the protection of the rubber valve and sealing surface of this unit. Consequently the spoke sections must be amply strong to perform this function.

Sink mark difficulties were also encountered in molding this part, and it was only after the gates were increased to approximately .150 in. that this difficulty was overcome. Production on the 12-cavity mold for this guard runs approximately 950 heats in 8 hrs. and the job is being run in a standard 4-oz. injection machine. A gate-cutting mechanism (Fig. 7) similar to the one used on the body was also designed for this mold, and an unscrewing fixture of a design similar to the body unscrewing fixture was used. The one difference in this unscrewing fixture is that 12 unscrewing chucks were used, thereby permitting all 12 guards to be unscrewed from the threaded rings merely by turning one crank. The use of this unscrewing fixture is one of the main reasons for the high production of 950 heats in 8 hours.

After these parts have been molded, the highly important finishing and assembly operations must be undertaken. In Fig. 8 it will be seen that the molded pin is glued into the body or valve portion. The accuracy with which this pin is assembled in the body is highly important inasmuch as the height of the shoulder of the pin above the sealing surface controls the accuracy and efficiency of the sealing of the rubber valve. As shown in the drawing, Fig. 16, the dimension from the sealing surface of the body part to the underside of the shoulder pin is given as .180 in. to .190 inches. This tolerance of plus .010 in. minus .000 in. must be held, and it is so important that a 100 percent gaging operation is specified for this dimension. Any body and pin assemblies not passing this gaging operation are considered as rejected parts, and from this fact can be seen the reason for the careful design of the pin assembly fixture.

A standard small arbor press was used in conjunction with a small air cylinder so that an up-and-down motion of the rack could be attained automatically. Fastened to the underside of the rack of this arbor press is a cup formed as shown in Fig. 8. The inside dimensions of this cup are such that when the bottom of the cup presses on the sealing surface of the body, and the center portion of the cup presses on the top of the molded pin, the pin is forced into the center hole of the body exactly to the predetermined dimension, which is .180 in. to .190 in. plus the thickness of the shoulder of the pin. The assembly operation is as follows:

The lower portion of the molded pin is placed in a small hole of an acetone reservoir (Fig. 8). Acetone flows all around the pin but is not allowed to splash on its top. The valve body is then placed on a fixture centered beneath the rack of the arbor press, the pin is inserted in the center hole by hand, and a foot lever operates an air valve which causes the air cylinder to push the rack of the arbor press downward. This rack continues to descend until the lower portion of the cup presses against the sealing surface of the valve. At this point the pin has then been assembled to its correct dimension. Originally, this assembly fixture was (*Please turn to page 128*)

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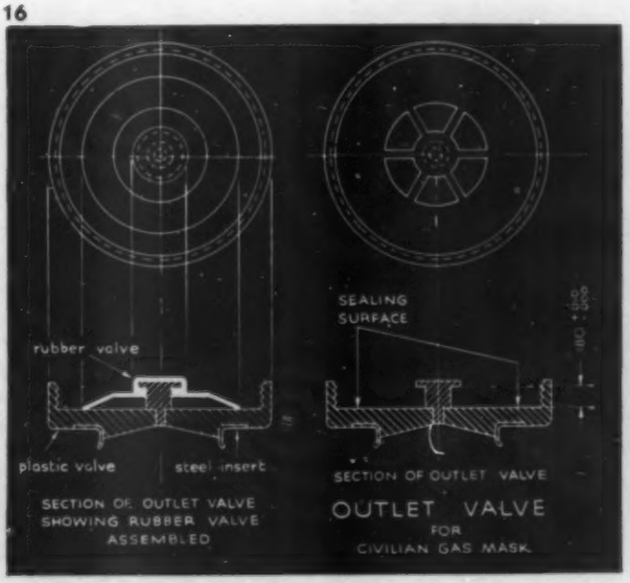

16—*Section view of outlet valve.* **17**—*First position in assembly to facepiece by means of latching metal clamp. Canister and mask shown in position in foot press.* **18**—*Final position of latching mechanism, with tightened clamp*

PHOTOS, COURTESY TINNERMAN PRODUCTS, INC.

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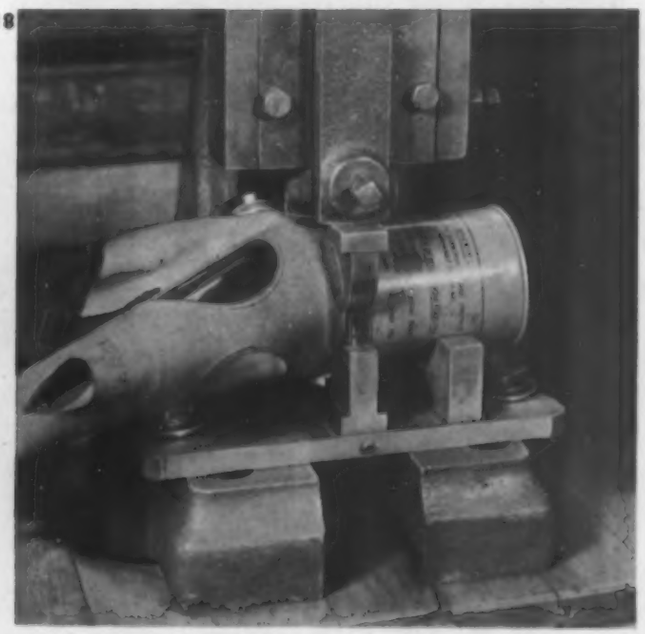

Drop hammer, hydraulic press punches*

ALL PHOTOS, COURTESY VEGA AIRCRAFT CO.

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1—This lead drop hammer punch is out of production while it is being scraped to allow for metal thickness. A plastic punch will recoil to accommodate thickness of part. 2—Plastic punch doesn't require these rubber strips to form metal down to small radii, and thus saves time

FACED with a shortage of metals for the tools that fashion their planes, the Vega Aircraft Corp. early in 1942 began to replace some of their steel and dural tools (such as drill jigs, saw jigs, router blocks, checking fixtures, dies, punch jigs, etc.)† with tools of plastics. Their latest step in a program for using plastics where they can do the job is Vega's use of a plastic punch in drop hammer and hydraulic presses.

The company feels that more consistent forming of sheet metal parts and more rapid production of such parts can be accomplished through the use of the new punch which, tough, elastic and possessing great impact strength, is 100 percent reclaimable without sacrifice of physical properties. The material used as a replacement for lead and Kirksite punches is a phenol acetone thermoplastic casting material manufactured by a West Coast company. First trials of this plastic were very promising, and many further tests followed, formulations being constantly altered to meet the high impact required for such metal forming.

Drop hammer punches

Advantages of the plastic punch may be judged from a brief review of steps necessary in making and using a lead drop hammer punch. Lead is cast to the Kirksite die without allowing for metal thickness of the part. Thus, the die must be set up in the hammer and the vertical surfaces scraped into the die to allow for metal thickness. The drop hammer is obviously out of production during the operation. Further, it is often necessary to re-scrape the punch after a number of parts have been formed because the soft lead tends to flatten and spread. Small radii on the punch are likewise beaten back, resulting in larger radii than obtained originally, so that rubber strips must be so placed in the die as to form the metal down to the small radii. Since this condition frequently arises when as few as 10 parts have been formed, production on the lot is appreciably slowed. An alternative is to run the whole lot through and then rehit the parts during a second run, using rubber. Either method involves a loss of time.

The plastic punch, like lead, is cast directly to the die, without clearance for metal thickness. Beyond this point, the simplicity and economy of the plastic punch method become apparent: the punch and die are set up in the drop hammer, and parts are then run. It is unnecessary to scrape the punch into the die. Being elastic, it simply springs back to accommodate metal thickness of the part, recoil accounting for its excellent forming characteristics. The same qualities account for consistent forming of small radii, beads and the like. It is unnecessary to use rubber strips to form beads. The useful life of a plastic punch has proved many times that of lead. In general, the plastic punch seems to possess the same characteristics as rubber under pressure and, when used in the drop hammer, combines the forming advantages of impact. It most consistently forms the part *true to the die*.

* The following article has been prepared from data compiled by Tool Research Engineering for Vega Aircraft Co., in collaboration with Leon Champer, chief chemist, Plastalloy Co.

† See "Tooling for Aircraft Production," MODERN PLASTICS, *19*, 33–7, 104–8 (July 1942).

Other savings in production time and expenses are illustrated by the following typical example of a lead and a plastic punch used at Vega.

Kirksite die with lead punch

Hit approximately 100 parts one time
Anneal
Pour new punch
Rehit 10 parts
Rehit 90 parts using rubber strips to force out radii (from 3 to 6 rehits may be required to produce a satisfactory part)
Finished

Kirksite die with plastic punch

One fairly good blow to set
Three blows in rapid succession
Finished

It can be seen that by using a plastic punch, an annealing operation and a rehit operation have been avoided. Foundry as well as drop hammer time is saved, since it is unnecessary to pour a second punch.

In their present stage of development, plastic punches cannot be used on all types of jobs, but those parts which are most adapted to this method of forming may be determined readily. Due to their rubber-like nature, plastic punches do not iron out wrinkles so readily as do lead or Kirksite. But, due to their close fit, fewer wrinkles occur in the first place. This type of punch is less successful, in many cases, in forming stainless steel parts, although often the same part in aluminum would form well.

Precautions are necessary when setting up the punch in the hammer to avoid subsequent cracking of the punch. Threaded inserts located in the punch should line up with holes in the head of the hammer. Otherwise when the stud bolts which are screwed into the inserts are forced into the hammer, strains are set up in the plastic which are considerably multiplied by impact of the punch in use. Hole locations in the Vega hammers are not uniformly located, but this difficulty has been overcome by using $^{7}/_{8}$-in. studs in the $1^{1}/_{16}$-in. holes. Nuts used on these studs must be firmly tight, but not cinched up with tremendous pressure as when using a lead punch. Since most breakage of punches has been found traceable to cracks developing at the metal inserts, these precautions alone have served to reduce such troubles to a minimum. Results are also more successful if the plastic is warm (75° to 100° F.) when set up in the drop hammer. The precautions mentioned should be observed even though a plastic material has now been developed which the drop hammers have not in most instances been able to break.

Hydraulic press punches

Success in the drop-hammer field led to the development of thermoplastic punches for use in the double action hydraulic press. The long hours of tedious grinding required to fit the punch to the die and allow for metal thickness are avoided because the plastic punch is again poured directly to the die, and set up in the press ready to go. Due to its elastic nature, the punch forms the part true to the die. A limited amount of clearing of sides or shoulders is sometimes found necessary in order to secure better bottoming as, for example, when beads are to be formed in the bottom of a part. This can be accomplished, however, while the punch is in the press, whereas the Kirksite punch and die are pulled and later set up again for another trial. (*Please turn to page 130*)

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***3**—Cabinetmaker's clamps prevent plastic material from shrinking away from the die, by forcing it to shrink from the top down as it cools.* ***4**—Flap-track fairing at left has been formed with plastic punch, here shown in the punch press.* ***5**—Employee holds part formed on double-action press equipped with a plastic punch*

Treads and wheels for hand trucks

ONE of the last plastic materials you might expect to find serving as a rubber replacement would be either a general purpose phenol-formaldehyde or a high impact phenol-formaldehyde molding compound. Yet one large manufacturer of restaurant equipment and industrial hand trucks, when faced with a shortage of rubber for wheel treads, turned to just those materials and is now reporting some surprising results.

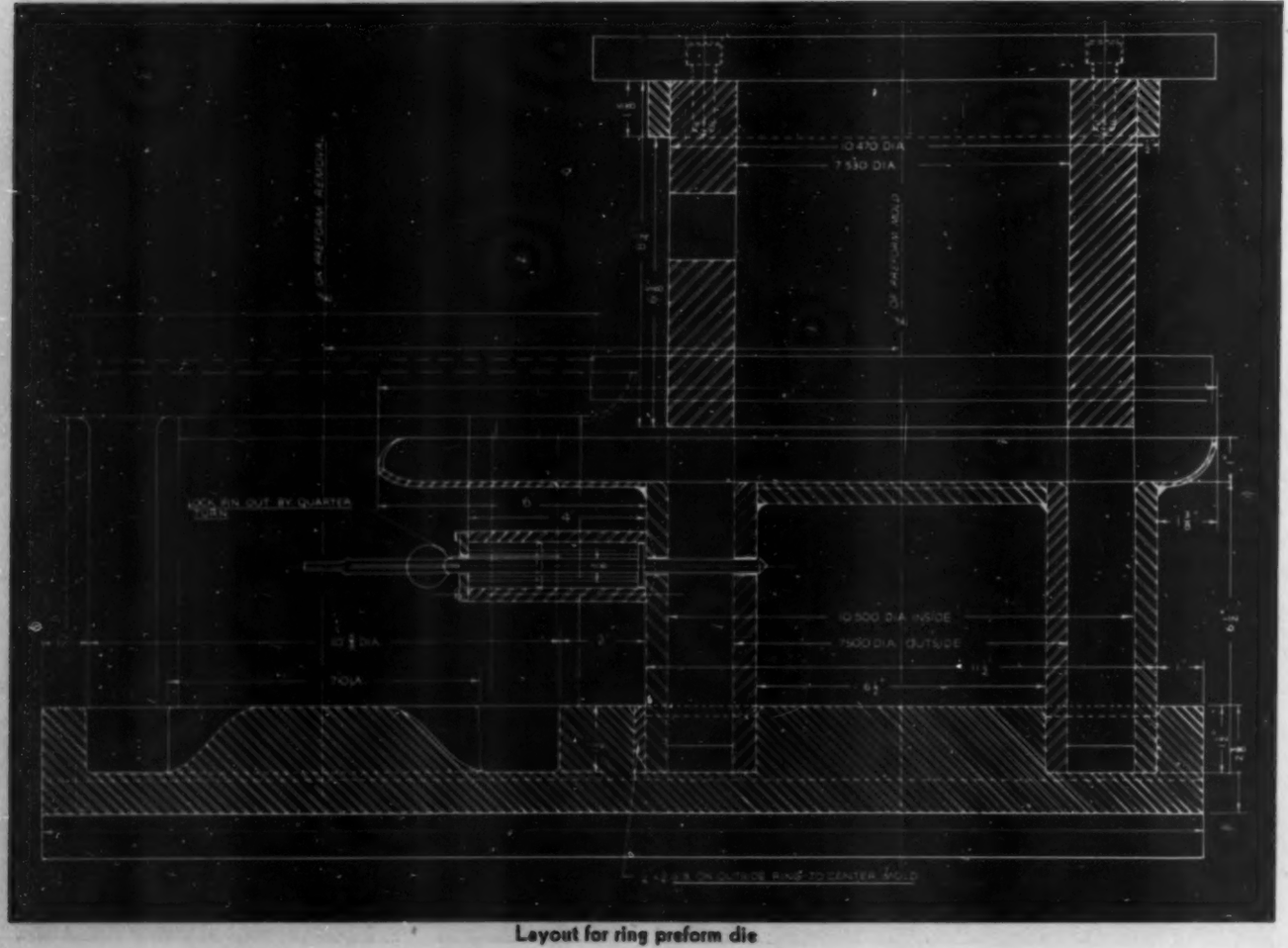
When the first experimental treads were produced several months ago with the help of technical service engineers of a large plastics materials company, test equipment was rigged to determine their wearing qualities under actual service conditions. A complete caster, fitted with one of the treads, was bolted to the box, loaded with a total of 800 pounds. One-half inch steel cleats were then welded to a broad steel pulley wheel, which was geared to revolve at about 8 r.p.m., roughly equal to the normal walking speed at which the equipment would operate. The phenolic-tired caster with its 800-pound load was then allowed to ride on the wheel as it revolved. The caster jounced over the cleats, reproducing many times the bumps the tires would take in service as they rolled off freight elevators and over uneven plant floors.

After several days of continuous bumping and jolting, the test was finally discontinued when grooves were worn completely through the steel cleats and even into the pulley wheel itself without a sign of wear on the phenolic treads. With this positive proof that phenolic treads would stand up in almost any service they might be called upon to perform, the equipment company promptly placed production orders for the molding of these parts. Orders for production molds were placed for 3 different diameter treads—5-in., 8-in. and 10-inch. Due to the large size of these molds, difficulty was encountered in obtaining tool steel forgings within a reasonable length of time. To eliminate this delay, the molds were redesigned so that they could be made up in sections, for in order to get the necessary molds in the shortest possible time steel which was readily available had to be used. Figures 2 and 3 show this sectional mold design.

In molding pieces of this type it was found necessary to make use of preforms, which, due to their large size, presented a most difficult problem. The conventional type of preform die would have required a press with a ram travel of approximately 20 in., and as the two molders in production on these jobs did not have small presses available with this long ram travel, a new departure in preform dies was conceived.

Figure 1 gives the general layout and details of this preform die. It consists of two individual metal sleeves which are not attached to either the lower or the upper platen of the

1



Layout for ring preform die

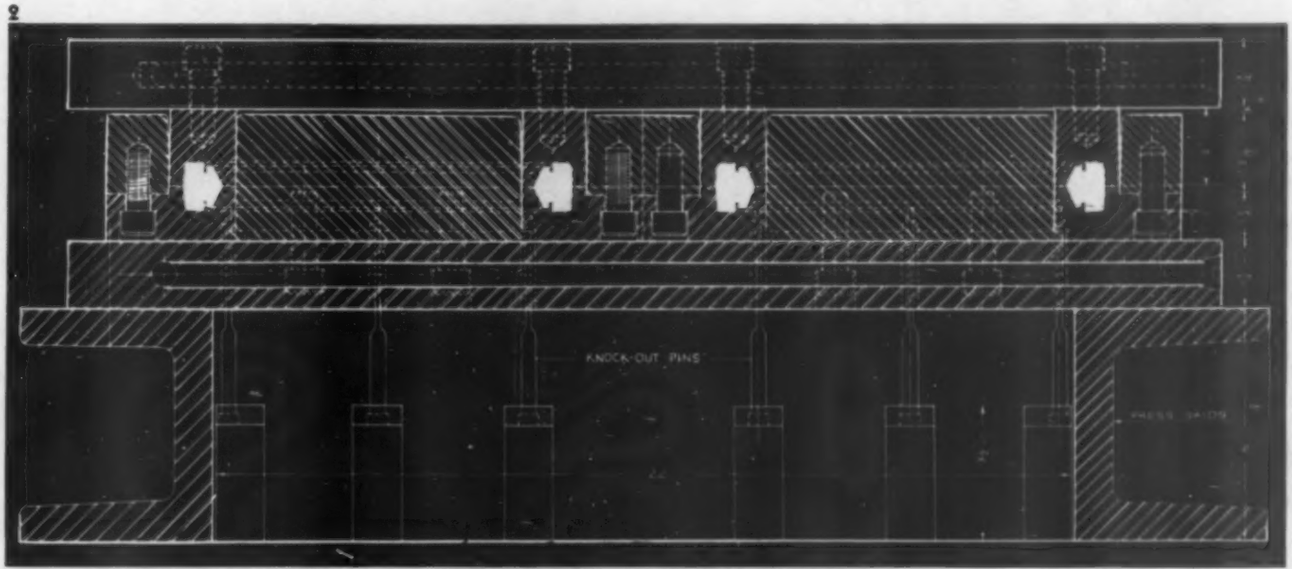
press. In studying the drawing of the preform die, it can be seen that these sleeves fit into a recess on one end of the lower plate with sufficient clearance to enable the sleeves to slide freely in or out of this recess. A circular pan is welded to the upper part of the outside sleeve to facilitate the loading of the material for the preform. The inside sleeve has a plate welded over the top in order to keep the material from dropping inside the inner sleeve when the material is being loaded. The area between these two sleeves thus becomes the cavity of the preform die. The force plug of this die is merely an annular ring of such a size that it will enter freely the space between the two circular sleeves.

The preforming operation is as follows: the material is first accurately weighed and poured onto the pan welded to the outside sleeve. It is then uniformly worked down into the space between the two sleeves, after which the die is closed. Using a pressure of approximately 1500 lb. per sq. in., a preform is formed at the bottom of the two sleeves. Inasmuch as the high pressure is exerted only when the force plug is near to the end of its stroke, it can be seen that the side pressure being exerted through the sleeves is counteracted by the sides of the recess in the lower plate. The sleeves, therefore, are not permitted to spread when the high pressure is turned on.

The next problem in the design of this preforming die was to evolve some quick method for ejecting the preform. Looking at the drawing of the preform die (Fig. 1), it will be seen that the front half of the lower plate has an annular recess similar to the one in the rear portion. In order to knock out the preform from between the two sleeves, the lock pin shown on the drawing is passed through a hole in the outer sleeve, continuing through a hole in the force plug and finally passing through a hole in the inside sleeve. This operation thus locks the inner and outer sleeves together with the force plug so that, when the die is opened, both the inner and outer sleeves, together with the force plug, are held in a fixed position while the lower plate drops away from this assembly, thereby removing the sleeves from the recess in the lower plate.

When the sleeves are free from the lower plate, this plate is shoved toward the back of the press so that the recess in the front portion of this lower plate lines up with the sleeves,

2



Section of mold for 10-in. phenolic tire tread

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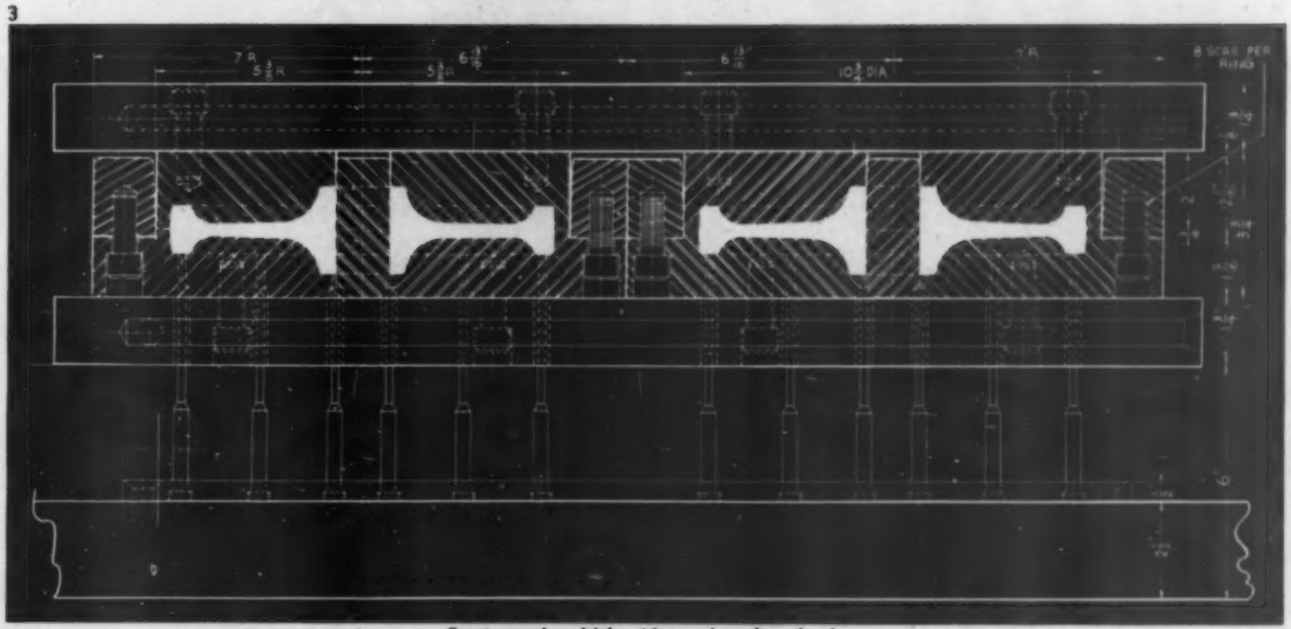
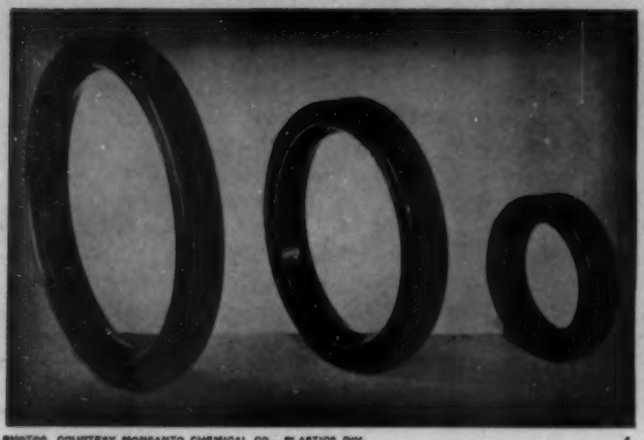
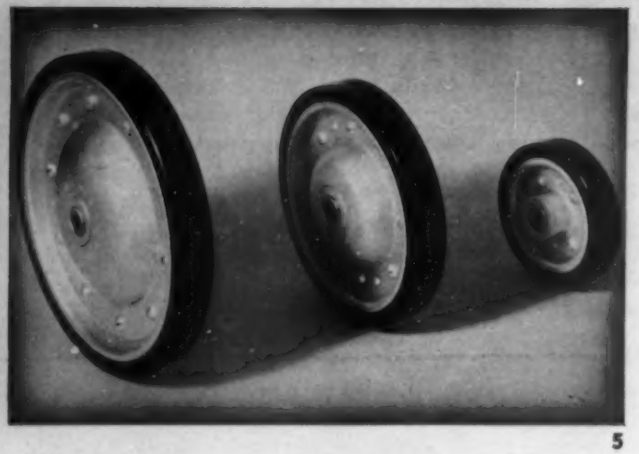


Sections of mold for 10-in. phenolic wheel



PHOTOS, COURTESY MONSANTO CHEMICAL CO., PLASTICS DIV.

4



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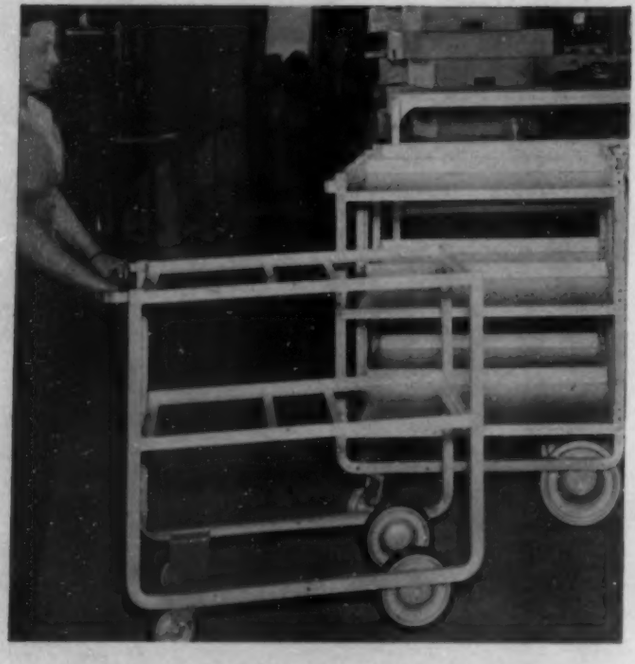


6

7

4,5—These three standard 5-, 8- and 10-in. wheels for hand trucks are now equipped with phenolic treads shown at left. 6—A group of finished plastic-tired trucks stands ready in the plant for crating and shipping. 7—The two steel halves of the wheel and the phenolic tread are quickly and easily assembled to the hub

and pressure then exerted on the ram and the lower plate travels upward until it comes to rest against the sleeves. In this position, it will be seen that the sleeves rest on the outer edges of the annular recess in the front portion of this plate. The locking pin is then withdrawn and pressure is then further exerted on the lower plate, pushing both sleeves upward along the force plug. With this motion the force plug automatically becomes a knock-out and forces the preform from between the inner and outer sleeves and into the annular recess in the front portion of the plate. The locking pin is then reinserted through the two sleeves and force plug; the lower plate is dropped away from this assembly and is then pulled into its original forward position; after which the inner and outer sleeves are again dropped into the recess in the rear portion of the lower plate. The locking pin is again withdrawn, permitting the force plug to be raised to its original loading position, ready for another load. The preform can then be pulled out of the front recess by means of thumb slots provided for this operation.

This procedure seems very complicated, but as a matter of fact, it works very rapidly; and the molder reports it is possible to make one preform in 1 min. and 20 sec., which includes the time for weighing out the material. It is possible to keep a 4-cavity mold running with this one preform die, making possible the use of a small press with a ram travel of from 12 to 14 inches.

With the accurate preforms obtainable with this unique preforming die all the molding problems have been simplified so that standard molding procedure is followed in the molding of these rims. A molding pressure of approximately 2½ tons per sq. in. and a temperature of 330° F. is used, and with the preforms preheated in an oven at 225° F. for 15 min., the curing time is approximately 6 minutes.

Figure 7 shows the method of assembly of the phenolic tread to the steel halves of the wheel. This same photograph shows that the inside diameter of the plastic treads has two beveled surfaces. As the two steel halves of the wheel are drawn tightly together, the outside peripheries of the steel wheels form a tight fit on the beveled surface of the treads, thus doing away with any possibility of slipping.

This equipment company, now that it has solved the problem of replacing the rubber tires, has gone even further in its conservation of essential raw materials. It has authorized the construction of molds of a solid plastic wheel and tread which will do away completely with the use of the two steel wheel halves. The only metal in the wheels will be two ball bearing races which will be assembled on each side of the solid wheel immediately after the wheels have (*Please turn to page 116*)

PHOTOS, COURTESY BOONTON MOLDING CO. 1 2 3

1—The comparometer in operation, checking wabble of a plastic part. **2**—*Close-up of the same finishing machine shows magnifying scanning mirror.* **3**—*Automatic gate-cutting machine has circular saws, a moving table which carries the sprue*

Standardized finishing fixtures

by RICHARD F. MAXFIELD*

THREE years ago our company decided to do something about its well-developed opinion that there was entirely too much hand work in molding and finishing plastics. Special tooling was commonly done on large production jobs that warranted the extra expenditure of money called for, but the average run of parts were hand molded and hand finished.

Two departments were set up and staffed, one to work on the molding end and one on the finishing. From the molding came the Sayre fully automatic press, now successfully in shop operation but not carried on to other models due to difficulties in getting raw materials under war conditions. From the finishing department is coming a series of standardized machines for various operations, some of which are pictured in this article.

The finishing problem was complicated by the need for finding out what tools to use to do the job of flash or material removing even before a machine itself could be designed. Phenolic parts are notoriously mean things to machine individually, and quantity only made the problem worse. Tools dull quickly, grinding wheels fill up, files are hard to handle mechanically, even diamond points need special study to get the right rake and shape. The first few months of the department's time was spent in working on such fundamentals.

The second problem came from the shapes and varying dimensions of the molded parts themselves. No two parts, even from the same cavity, seemed to be exactly alike on the flash line, and those from different cavities were definitely different. When a part was chucked on an inside diameter to turn off a flash from an outside diameter, a matter of a few thousandths eccentricity or variation in outer diameter stood out like an electric sign when the resulting chamfer at the flash line was examined. An edge varying from .005 in. to .010 in. at diametrically opposite points is a difference in width of 100 percent and clearly seen. This is easily taken care of in hand finishing but not so easily when a tool must come up on a fixed position.

The molding department merely shrugged its collective shoulders and admitted the variations. That's the way the pieces come, and probably the way they always would come. Nobody but the new Finishing Projects Department was going to do any worrying about the situation, so what!

So we had to develop a new, basic means of guiding the tool so as to remove the flash and a minimum of the piece itself with relation to the outer, visible surface of the piece. And that took time.

Our first finished attempt at a complete machine was pretty crude. We took a wooden table about 6 ft. in diameter and built seven stations around the edge. Fingers moved canal boats, on which the part had been clamped, around from station to station. The part was a toaster base requiring the following operations:

1. Grind flash from outside.
2. Remove flash from inside.
3. Drill 6 upright holes.
4. Drill one end hole.
5. Black wheel polish.

(*Please turn to page 114*)

* Finishing projects engineer, Boonton Molding Co.

Snake bite kit

IN THE tropical climates where American soldiers are currently fighting, the bite of a snake can be every bit as deadly as an enemy bullet. Prompt action in sucking the venom out of the lymph capillaries is the only method of preventing death or serious illness when a person is bitten by a poisonous reptile.

Ever on the alert to conserve man-power, the U. S. Army Medical Corps provides a handy field kit for immediate treatment of snake bite wounds to remove the venom before it begins to travel through the body. Furnished complete with tourniquet, bandages, iodine and ammonia capsules, and carried in a plastic case that is dustproof and watertight, the pump is used to create suction which draws out the venom after the wound is opened. Such treatment is continued for as long as thirty hours.

It is interesting to note that the venom travels in the lymphatics (from which a white fluid is drawn out) rather than in the blood of the person struck. In fact, it had long been common practice for a hunter, when bitten by a snake, to take his knife and immediately cut a series of incisions where the fangs had left their marks; after which, quickly pressing his lips to that portion of his body, he sucked on the wound until the venom was withdrawn. This method did not prove very efficient for many reasons, among them being the fact that even a slight abrasion in the mouth would permit the venom to re-enter the body. Another drawback was that this self-applied suction power could not be sustained the length of time necessary to remove the poison completely.

Originally designed for hunters in southern regions, this snake bite kit is now used extensively by the United States Army Medical Corps. Developed and patented by Paul Saunders in aluminum, the pump was such an improvement over the rubber bulb suction pump previously used that the Medical Corps wanted it for troops in the tropics. Due to the scarcity of aluminum it was redesigned for plastics and is proving much more satisfactory in its plastic form than it was in aluminum, principally because the plastic pump and kit are not so easily damaged in the field as were the aluminum. Since a fairly thin section of aluminum was necessary for the wall of the suction tube, it was easily bent, destroying the necessary precision with which the tube was required to operate.

The great problem involved in molding this part was holding very accurate dimensions throughout. The completed pump and case are made up of eleven individual parts, each of which must be a perfect fit in its matching part. These eleven parts consist of: five parts for the pump, two parts for the lance holder and cover, two crystal-clear cups and two parts to make up the threaded case and cover (see Fig. 1). As the pump works on a principle of check valves and vacuum, it must be realized that the tolerances would have to be very small, because any variation greater or less than that allowed for would completely ruin the action of the pump.

Another complication was the fact that the pump had to be designed so that it could be easily and completely disassembled in the field, cleaned and readily put together again. This called for a threaded assembly rather than cemented parts.

A seven-cavity combination mold was engineered to form seven parts: the cap and body of the pump, the pump plunger, the pump valve and washer, and the lance holder and case. These parts are all shown on the sprue just as they come from the mold in Fig. 2. It will be noticed from the shot of the pump parts that there is an internal thread on the cap, an external thread on the pump body, and that

1—As protection against snake bite in the tropics, the U. S. soldier is provided with this compact kit. 2—A 7-cavity injection mold forms 7 of the 11 plastic parts, here shown attached to the sprue as they come from the mold

1

2

the pump plunger has a metal insert which is molded-in. There are also four vertical core pulls and two undercuts on the other parts molded on this sprue.

A second mold was necessary for molding both the large and smaller-sized crystal-clear cups, and a third mold was used to mold the threaded case and closure.

Point "A" on the drawing (Fig. 3) shows the small washer which is assembled on the lower portion of the valve stem. This assembly is accomplished by means of an undercut in the washer and a rib molded around the stem. The function of this washer is to hold a spring in place. This spring exerts a constant pressure on the lower portion of the valve stem, thereby holding the upper portion of the valve firmly against the valve seat. Inasmuch as it is necessary to disassemble the valve for cleaning purposes, it was not possible to assemble the washer permanently by means of gluing. As a result, this snap-on method was devised and a molding problem arose where, due to the small washer and the amount of undercutting, a special ejecting mechanism and cooling system were necessary to prevent a variation in the dimensions of this washer.

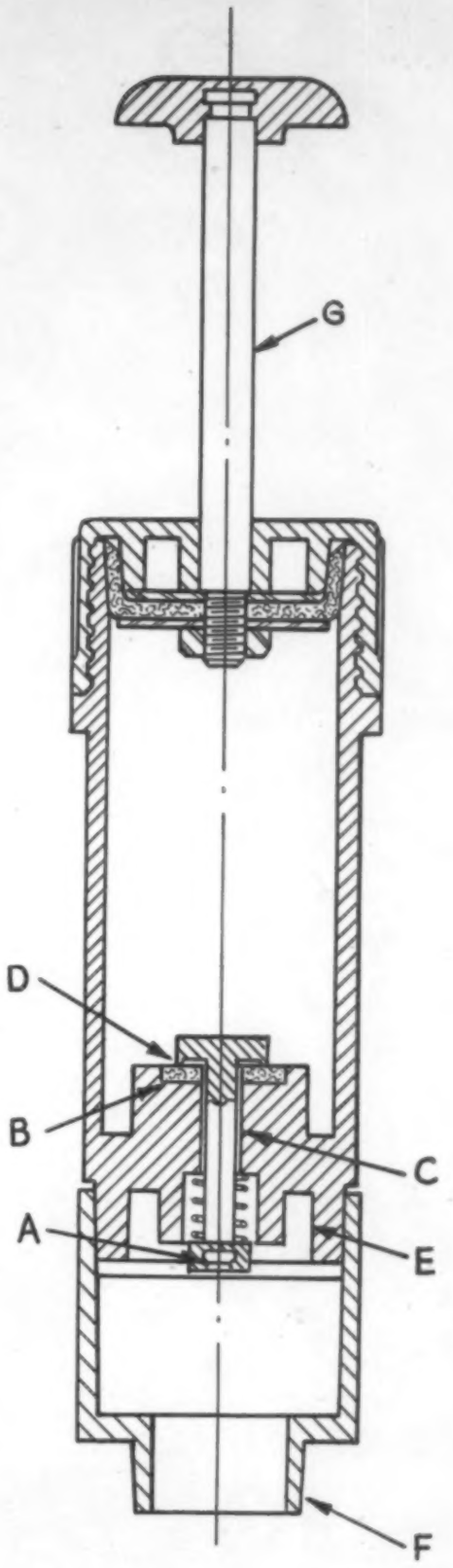
Point "B" shows the valve seat, which is a rubber washer inserted in a depression in the body of the pump. As this is surrounded by a comparatively heavy section, another special cooling system had to be installed at this point in the mold in order to do away with sink marks. This was also necessary in order to maintain a true and straight hole at point "C," which is the guide for the valve stem. Should a variation in the shrinkage take place at this point, the valve stem would cock and jam, thereby causing a leak and consequent loss of vacuum.

At point "D" it will be noticed that the sealing portion of the valve comes to a knife edge. This was required to seal perfectly on the rubber valve seat "B"; and as it was necessary to gate the valve at this point, a method of removing the gate had to be devised so that this knife edge would not be lost or injured during the process.

The brass plunger rod "G" and assembly is shown in the raised position. The lower threaded portion of the brass plunger is assembled to a standard leather pump washer which, when lubricated in the proper manner, will pull a 5 or 6-lb. vacuum in the pump unit.

The final portion of this pump assembly is known as the "venom cup." It will be noticed in the picture of the completed kit that there are two of these transparent plastic parts. These cups press-fit onto the lower end of the pump, and it is into these parts that the venom flows under action of the vacuum. These two cups are crystal-clear so that the sucking action may be continually observed. The pump is designed to allow the larger opening of one of the crystal parts to be assembled on the outside of the pump with a press fit, so that the small opening at the end of the cup may be used where a small area is to be covered by the pump. This cup may also be reversed so that the smaller end will fit in section "E," leaving a larger opening if desired for use over larger wounds. In addition, there is a tiny "finger opening" end on the smaller cup (which can slide over the opening "F" of the larger cup) for use when it is necessary to create a vacuum on the side of the finger. This would not be possible with the larger openings. This means that there are six different dimensions that had to be maintained absolutely accurately in order to create a press fit on any one of these combinations, because a looseness in any of the fits will prevent creation of the vacuum.

The action of the completed unit is as follows: plunger "G" is pushed to the lowest position (*Please turn to page 114*)



3—*Schematic drawing of the pump with venom cup press-fitted on its lower end. Close tolerances are demanded in its molding by the principle of check valves and vacuum on which it operates. Threaded assembly makes it easy to disassemble and clean the pump in the field*

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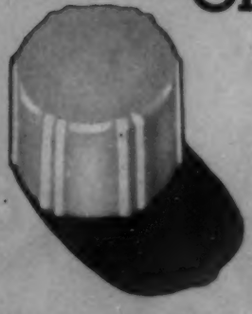

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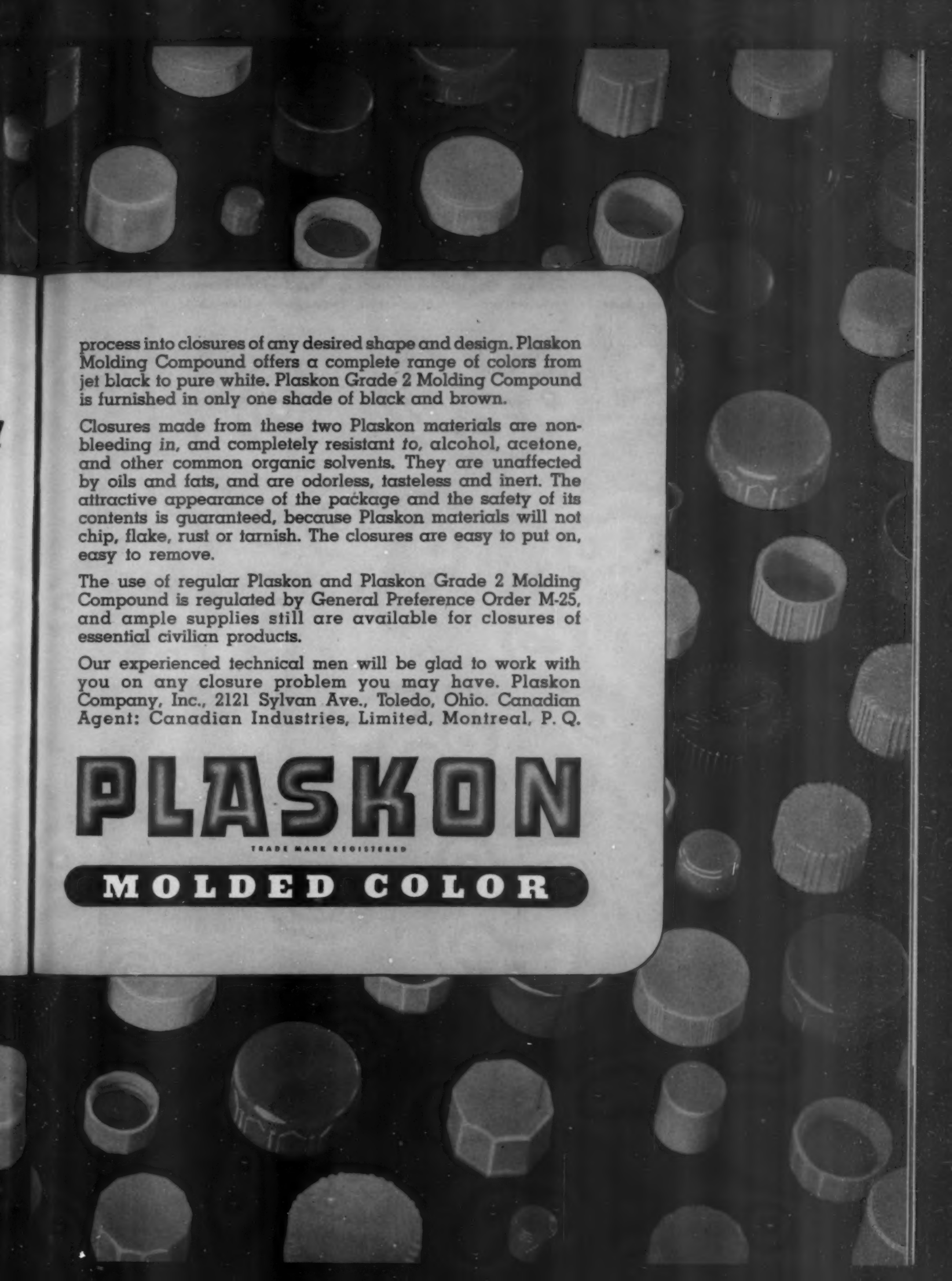

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1496. Curved handle, 4 1/4 in. long, 9/16 in. wide, mounting hole centers in base 3 in. apart. Metal strip insert 1/8 in. wide

1497. Round candle holder base, 3 1/4 in. diameter, 1 in. high. Color: red

1498. Leaf design candle holder base. Colors: black, red, green, white, and white with red berries

1499. Round knob, 1 1/8 in. in diameter, 1/2 in. high; 1/8 in. tap brass insert. Colors: red and black

1500. Step top knob, 1 in. high, 1 in. diameter. 1/8 in. tap brass insert. Colors: red and black

1501. Round valve handle, with grip ridges. 2 in. in diameter, 7/8 in. high. Color: black with white trim

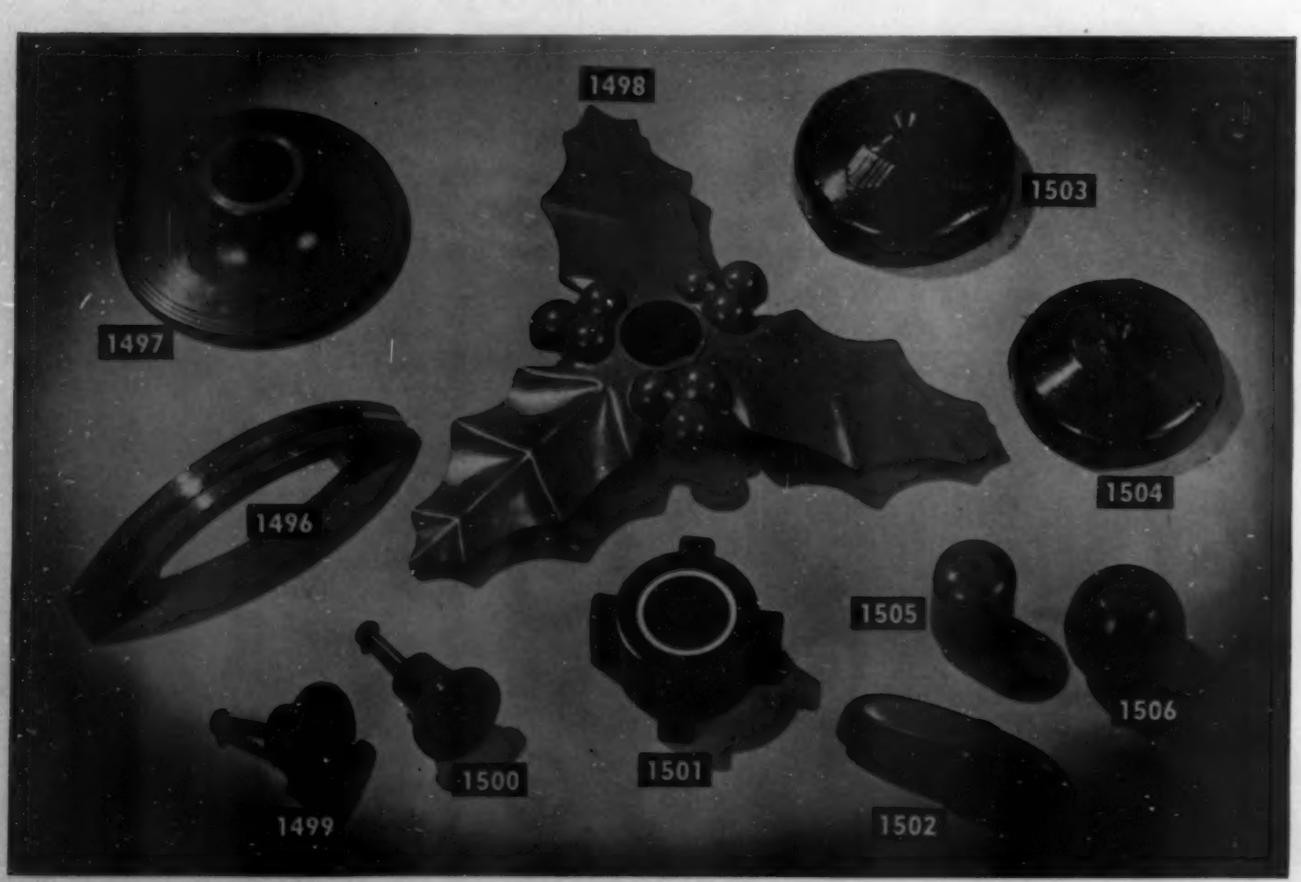
1502. Indicator knob, 2 1/2 in. long, 7/8 in. high. Colors: blue, red and black

1503. Round valve handle, 2 1/2 in. in diameter, 15/16 in. high. Lettering if desired. Color: black

1504. Valve handle same as 1503, but 2 1/4 in. in diameter, 13/16 in. high

1505. Roller, 15/16 in. in diameter. 1 7/32 in. in height. 1/8 in. hole through center. Black and red

1506. Oblate roller ball, 1 1/2 in. in diameter, 1 1/4 in. high; 1/8 in. hole through center. Black and red



Effects of continuous heat on phenolics*

by T. S. CARSWELL, D. TELFAIR and R. U. HASLANGER†

DATA on the serviceability of molded phenolic compositions at elevated temperatures over long periods of time are important, if these plastic materials are to be properly selected and designed for structural applications. There are numerous uses for phenolics which require that they withstand operating temperatures up to 80°–90° C. (172°–194° F.) either intermittently or continuously.

Some investigations have been made to determine the influence of temperature on mechanical properties of phenolics by testing at a range of temperatures.[1–7] This previous work has indicated that for phenolic materials conditioned only long enough to bring them to the temperature of testing:

1) Tensile and flexural strengths decrease gradually over the temperature range, asbestos-filled material showing less deterioration than organic-filled or pure resin;
2) Impact strengths of organic-filled materials show an increase or remain constant up to 140°–160° C. (285°–320° F.) and then fall off sharply, while the pure resin and asbestos-filled compositions remain practically unchanged even at 240° C. (465° F.).[1]

Azam[8] has reported on the effect of prolonged heating on the impact strength of phenolic laminated muslin and glass fabric at 150° C. (300° F.). Houwink[9] cites similar work by Nitsche and Salewski[10] on a number of phenolic materials. Delmonte[11] described the effect of continued heating at 200°, 300° and 400° F. on the impact strength of some laminated phenolics.

To supplement these data, research work was undertaken to determine the change of impact and flexural strengths with prolonged heating, up to 500 hr., at temperatures of from 110° to 225° C. (230° to 437° F.) for a number of molded phenol-formaldehyde plastics. Creep properties are also being studied over a range of temperatures, and will be reported at a later date.

Six different phenolic molding compositions were studied. Three materials containing organic fillers, woodflour, macerated fabric and cotton cord, and representing three grades of impact strength, were evaluated. These were composed of approximately 50 percent filler and 50 percent resin. Two inorganic-filled compositions were evaluated. One contained 50 percent asbestos fiber and 50 percent resin, and the other contained 60 percent mica and 40 percent resin. An unfilled pure phenolic resin was also included in the study.

The two high impact grade materials, containing macerated fabric and cord fillers, were prepared by blending the resin and filler in a wet-mix process to assure a uniform mixture and to obtain optimum strengths. The balance of the materials was processed on a set of differential rolls in the manner customary for the preparation of phenolic molding compositions. All six materials were from standard plant production and are typical of the classes which they represent.

Impact and flexural test specimens, $\frac{1}{2} \times \frac{1}{2} \times 5$-in. bars, of the impact grade materials were molded in a single-bar mold according to A.S.T.M. Tentative Specifications for Molds for Test Specimens of Molded Material used for Electrical Insulation (D 647–41 T).[12] The other four materials were molded in a 5-bar gang mold as specified in A.S.T.M. Specification D 647–41 T.[13]

Impact data were obtained on a Baldwin Southwark pendulum-type impact tester having a capacity of 4.0 ft.-lb. Tests were run according to the A.S.T.M. Tentative Methods of Test for Impact Resistance of Plastics and Electrical Insulating Materials D 256–41 T,[13] using the notched Izod method in which the stress is applied perpendicular to the molding pressure.

Flexural data were obtained on a Tinius Olsen universal tester, a screw-type machine with a constant rate of crosshead motion (0.05 in. per min.) and 10,000 lb. range. Flexural tests were run according to the procedure outlined in A.S.T.M. Tentative Method of Test for Flexural Strength of Electrical Insulating Materials.[14]

Specimens to be tested at 25° C. (77° F.) were conditioned, according to A.S.T.M. Tentative Methods for Preconditioning Plastics and Electrical Insulating Materials for Testing (D 618–41 T),[15] for 48 hr. at 50° C. ± 3° C. (122° ± 5.4° F.) and placed in a desiccator after removal from the oven. Other specimens upon which the effect of heating was to be studied were heated in a circulating air oven held to within ± 5° C. of the desired temperature. Specimens were baked for 2, 6, 18, 54, 162 and 500 hr. at temperatures of 110° C. (230° F.), 140° C. (284° F.), 170° C. (338° F.), 200° C. (392° F.) and 225° C. (437° F.). After the desired baking

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* This paper was presented before the Rubber and Plastics Group of the American Society of Mechanical Engineers at New York, N. Y., on Dec. 3, 1942, and is published here through the courtesy of that Society.

† Plastics Division, Monsanto Chemical Co.

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[12] 1941 Supplement to Book of A.S.T.M. Standards, Part III, p. 317.

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[14] Ibid., p. 336.

[15] Ibid., p. 320.

TABLE I.—IMPACT STRENGTH VERSUS TIME OF HEATING AT 110° C. FOR MOLDED PHENOLIC PLASTICS

Time	Pure phenolic resin	Woodflour-filled phenolic	Fabric-filled phenolic	Cord-filled phenolic	Mica-filled phenolic	Asbestos-filled phenolic
hr.	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch
0	0.220±0.01	0.280±0.02	2.86±0.27	5.90±0.28	....	....
2	0.230±0.016	0.257±0.014	2.68±0.18	6.40±0.18	....	....
6	0.236±0.018	0.263±0.015	2.64±0.16	5.77±0.43	....	....
18	0.201±0.007	0.270±0.013	2.67±0.21	5.52±0.50	....	....
54	0.213±0.010	0.271±0.020	2.57±0.12	5.20±0.56	....	....
162	0.226±0.010	0.271±0.016	2.42±0.10	5.30±0.10	....	....
500	0.205±0.007	0.260±0.011	2.22±0.11	5.36±0.23	....	....

TABLE II.—IMPACT STRENGTH VERSUS TIME OF HEATING AT 140° C. FOR MOLDED PHENOLIC PLASTICS

Time	Pure phenolic resin	Woodflour-filled phenolic	Fabric-filled phenolic	Cord-filled phenolic	Mica-filled phenolic	Asbestos-filled phenolic
hr.	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch
0	0.220±0.010	0.280±0.020	2.86±0.27	5.90±0.28	0.316±0.007	0.280±0.010
2	0.254±0.018	0.268±0.021	2.69±0.13	5.88±0.20	0.315±0.006	0.262±0.013
6	0.222±0.010	0.249±0.015	2.60±0.17	5.65±0.34	0.328±0.008	0.271±0.007
18	0.202±0.009	0.264±0.018	2.57±0.19	5.49±0.26	0.303±0.011	0.283±0.009
54	0.215±0.025	0.290±0.019	2.31±0.15	5.66±0.53	0.310±0.015	0.275±0.022
162	0.205±0.066	0.274±0.013	2.16±0.12	4.77±0.11	0.286±0.014	0.300±0.010

TABLE III.—IMPACT STRENGTH VERSUS TIME OF HEATING AT 170° C. FOR MOLDED PHENOLIC PLASTICS

Time	Pure phenolic resin	Woodflour-filled phenolic	Fabric-filled phenolic	Cord-filled phenolic	Mica-filled phenolic	Asbestos-filled phenolic
hr.	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch
0	0.220±0.010	0.280±0.020	2.86±0.27	5.90±0.28	0.316±0.007	0.280±0.016
2	0.210±0.008	0.258±0.019	2.58±0.15	6.26±0.11	0.330±0.013	0.294±0.013
6	0.199±0.003	0.274±0.010	2.29±0.10	5.50±0.30	0.322±0.016	0.293±0.010
18	0.195±0.009	0.259±0.014	2.20±0.10	4.30±0.42	0.316±0.016	0.312±0.009
54	0.202±0.004	0.238±0.019	1.81±0.06	3.24±0.30	0.326±0.016	0.338±0.007
162	0.193±0.005	0.231±0.017	1.37±0.210	0.65±0.08	0.298±0.013	0.308±0.008

TABLE IV.—IMPACT STRENGTH VERSUS TIME OF HEATING AT 200° C. FOR MOLDED PHENOLIC PLASTICS

Time	Pure phenolic resin	Woodflour-filled phenolic	Fabric-filled phenolic	Cord-filled phenolic	Mica-filled phenolic	Asbestos-filled phenolic
hr.	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch
0	0.220±0.010	0.280±0.020	2.86±0.27	5.90±0.28	0.316±0.007	0.280±0.010
2	0.200±0.005	0.280±0.060	....	5.10±0.600	0.320±0.020	0.320±0.010
6	0.202±0.013	0.260±0.020	....	4.30±0.500	0.320±0.010	0.300±0.010
18	0.200±0.006	0.220±0.020	....	0.91±0.090	0.340±0.020	0.330±0.020
54	....	....	....	0.29±0.020	0.310±0.010	0.340±0.010
162	....	....	....	....	0.310±0.007	0.357±0.080

TABLE V.—IMPACT STRENGTH VERSUS TIME OF HEATING AT 225° C. FOR MOLDED PHENOLIC PLASTICS

Time	Pure phenolic resin	Woodflour-filled phenolic	Fabric-filled phenolic	Cord-filled phenolic	Mica-filled phenolic	Asbestos-filled phenolic
hr.	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch	ft.-lb./in. of notch
0	0.220±0.010	....	....	....	0.316±0.007	0.280±0.010
2	0.184±0.005	....	....	....	0.295±0.014	0.279±0.010
6	....	....	....	....	0.283±0.007	0.299±0.007
18	0.185±0.005	....	....	....	0.282±0.010	0.288±0.007
54	....	....	....	....	0.297±0.012	0.277±0.017
162	....	....	....	....	0.281±0.010	0.296±0.008
500	....	....	....	....	0.253±0.006	0.273±0.005

time, the specimens were cooled to 25° C. (77° F.) in a desiccator and tested.

The impact values reported represent the average of from 10 to 20 individual observations, while the flexural strength values are the average of from 5 to 10 individual results. The attached tables include the limits within which the observed value may be expected to lie 9 times in 10, limits of uncertainty, calculated according to the methods outlined in the A.S.T.M. Manual on the Presentation of Data.[16]

Tables I, II, III, IV and V present the impact data and Tables VI, VII, VIII, IX and X present the flexural data

[16] Issued as a separate publication of the A.S.T.M.

TABLE VI.—FLEXURAL STRENGTH VERSUS TIME OF HEATING AT 110° C. FOR MOLDED PHENOLIC PLASTICS

Time	Pure phenolic resin	Woodflour-filled phenolic	Fabric-filled phenolic	Cord-filled phenolic	Mica-filled phenolic	Asbestos-filled phenolic
hr.	p.s.i.	p.s.i.	p.s.i.	p.s.i.	p.s.i.	p.s.i.
0	13,600 ± 500	9,790 ± 370	13,200 ± 830	13,050 ± 710	....	....
2	13,000 ± 1550	9,290 ± 390	12,900 ± 270	12,200 ± 900	....	....
6	13,900 ± 2040	9,780 ± 390	12,700 ± 1010	12,800 ± 650	....	....
18	13,000 ± 1070	9,390 ± 240	12,200 ± 820	12,700 ± 720	....	....
54	13,300 ± 1210	9,880 ± 640	12,900 ± 810	12,300 ± 700	....	....
162	13,500 ± 1850	9,780 ± 420	12,800 ± 1060	12,600 ± 820	....	....
500	10,800 ± 2800	10,900 ± 470	13,400 ± 540	12,900 ± 750	....	....

TABLE VII.—FLEXURAL STRENGTH VERSUS TIME OF HEATING AT 140° C. FOR MOLDED PHENOLIC PLASTICS

Time	Pure phenolic resin	Woodflour-filled phenolic	Fabric-filled phenolic	Cord-filled phenolic	Mica-filled phenolic	Asbestos-filled phenolic
hr.	p.s.i.	p.s.i.	p.s.i.	p.s.i.	p.s.i.	p.s.i.
0	13,600 ± 500	9,790 ± 370	13,200 ± 830	13,000 ± 710	12,200 ± 720	6960 ± 330
2	13,400 ± 850	10,500 ± 410	12,500 ± 870	12,600 ± 760	10,900 ± 560	7320 ± 600
6	12,900 ± 940	10,100 ± 460	12,500 ± 750	11,000 ± 680	11,100 ± 500	7260 ± 600
18	13,800 ± 1030	10,600 ± 230	12,400 ± 840	11,500 ± 860	10,900 ± 370	7450 ± 780
54	12,830 ± 1230	10,400 ± 400	12,700 ± 770	10,400 ± 1070	10,800 ± 410	8870 ± 380
162	12,810 ± 1120	11,000 ± 320	13,700 ± 700	10,900 ± 360	11,400 ± 550	9330 ± 710

TABLE VIII.—FLEXURAL STRENGTH VERSUS TIME OF HEATING AT 170° C. FOR MOLDED PHENOLIC PLASTICS

Time	Pure phenolic resin	Woodflour-filled phenolic	Fabric-filled phenolic	Cord-filled phenolic	Mica-filled phenolic	Asbestos-filled phenolic
hr.	p.s.i.	p.s.i.	p.s.i.	p.s.i.	p.s.i.	p.s.i.
0	13,600 ± 500	9,790 ± 370	13,200 ± 830	13,000 ± 710	12,200 ± 720	6960 ± 330
2	12,900 ± 800	10,000 ± 490	12,600 ± 750	10,800 ± 840	10,600 ± 530	7690 ± 530
6	12,000 ± 880	10,400 ± 550	12,200 ± 790	9,790 ± 620	10,700 ± 560	8200 ± 430
18	11,900 ± 980	10,800 ± 130	11,100 ± 600	9,260 ± 350	10,600 ± 700	9190 ± 280
54	10,800 ± 490	10,200 ± 400	11,200 ± 840	8,110 ± 730	10,800 ± 640	9350 ± 300
162	9,470 ± 440	9,610 ± 270	11,050 ± 670	4,580 ± 400	10,900 ± 420	9780 ± 370

TABLE IX.—FLEXURAL STRENGTH VERSUS TIME OF HEATING AT 200° C. FOR MOLDED PHENOLIC PLASTICS

Time	Pure phenolic resin	Woodflour-filled phenolic	Fabric-filled phenolic	Cord-filled phenolic	Mica-filled phenolic	Asbestos filled phenolic
hr.	p.s.i.	p.s.i.	p.s.i.	p.s.i.	p.s.i.	p.s.i.
0	13,600 ± 500	9,790 ± 370	....	13,000 ± 710	12,200 ± 720	6960 ± 330
2	11,300 ± 1000	10,400 ± 350	....	10,000 ± 670	10,200 ± 450	9230 ± 390
6	11,900 ± 940	10,400 ± 490	....	9,210 ± 730	10,500 ± 310	8700 ± 600
18	9,060 ± 540	9,600 ± 430	....	8 440 ± 700	10,300 ± 730	9130 ± 450
54	....	8,620 ± 340	....	5,130 ± 160	10,100 ± 770	9200 ± 430
162	8,680 ± 980	....	....	3,280 ± 230	10,800 ± 700	9100 ± 210

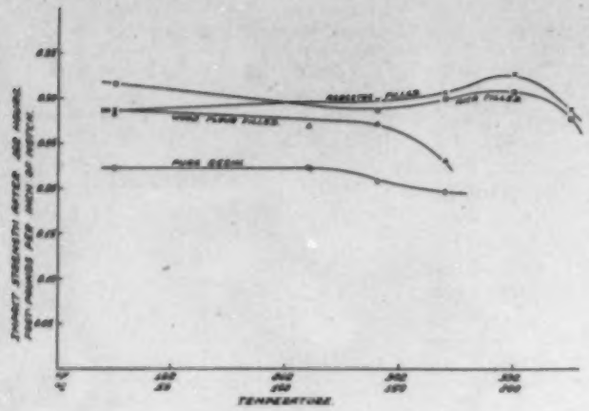
TABLE X.—FLEXURAL STRENGTH VERSUS TIME OF HEATING AT 225° C. FOR MOLDED PHENOLIC PLASTICS

Time	Pure phenolic resin	Woodflour filled phenolic	Fabric-filled phenolic	Cord-filled phenolic	Mica-filled phenolic	Asbestos-filled phenolic
hr.	p.s.i.	p.s.i.	p.s.i.	p.s.i.	p.s.i.	p.s.i.
0	13,600 ± 500	....	....	....	12,200 ± 720	6960 ± 330
2	10,300 ± 720	....	....	....	9,740 ± 280	8310 ± 540
6	9,630 ± 940	....	....	....	9,560 ± 580	9590 ± 580
18	7,620 ± 530	....	....	....	10,500 ± 420	9740 ± 500
54	10,400 ± 550	....	....	....	10,800 ± 900	8590 ± 710
162	5,830 ± 2,470	....	....	....	9,880 ± 840	7980 ± 440
500	5,880 ± 1,850	....	....	....	10,100 ± 710	5440 ± 420

obtained at the various times and temperatures. In some instances, evaluations at the higher temperatures were not made, because it was obvious that the material had already reached a limit of serviceability at a lower temperature.

All of the materials stand up well at 110° C. (230° F.). Even after 500 hr. there is no appreciable loss in either impact or flexural strength except in the case of the pure resin, which exhibits a loss in flexural strength of about 20 percent. The materials show only a slight tendency to blister or distort during the prolonged heating at this temperature.

At 140° C. (284° F.) a loss in impact strength is apparent in the fabric-filled material after 54 hr. and in the cord-filled material after 162 hours. The flexural strength of the cord-filled specimens falls off gradually after 6 hr. at 140° C. (284° F.) but after 162 hr. has decreased by only 16 percent from the original value. The strengths of the pure resin, as



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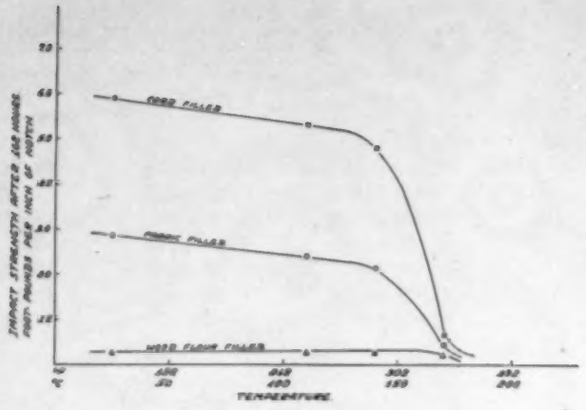

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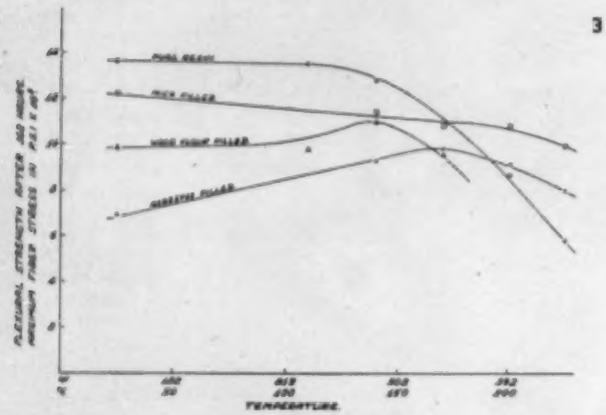

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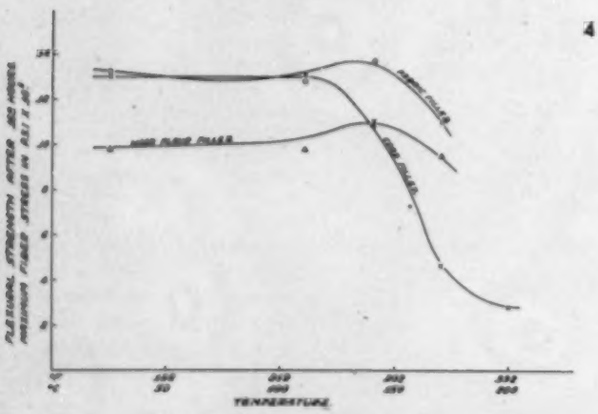


4

1–4—*Effect of heating at several temperatures for 162 hr. on impact and flexural strengths of molded phenolic compositions.* **5–6**—*Change of impact and flexural strengths with time of heating at 110° C. for certain materials*

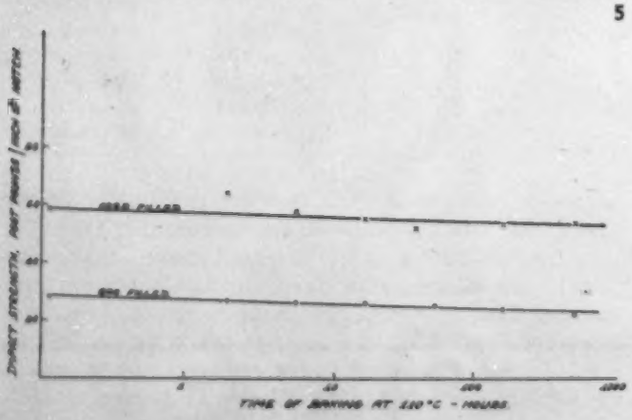
well as of the materials containing woodflour, mica and asbestos fillers, are unaffected even after 162 hr. at 140° C. (284° F.).

The woodflour-filled and pure resin specimens begin to show a gradual loss in impact strength after 6 to 18 hr. at 170° C. (338° F.), while the flexural strength of the pure resin and of the fabric-filled specimens shows a drop after 6 hours.

The mica-filled product begins to show a slight loss in both impact and flexural strength at 225° C. (437° F.) but the asbestos-filled material stands up well even after 500 hr. at this temperature. There is a tendency for these materials to blister at this temperature during heating, indicating a deterioration of the filler as well as of the resin.

Figures 1, 2, 3 and 4 are presented to show the effect on impact and flexural strengths of heating at several temperatures for 162 hours. From these curves it may be seen that the organic-filled materials remain practically unchanged up to 130°–140° C. (266°–248° F.), at which point the strengths fall off rapidly. In some instances the materials will withstand temperatures up to 170° C. (338° F.) for a relatively short period of time before breaking down. The asbestos- and mica-filled compositions show no appreciable loss in strength at temperatures below 200°–220° C. (392°–428° F.). The curves presented in Figs. 5 and 6 illustrate the change of impact and flexural strengths with time of heating at 110° C. for certain of the materials tested.

Table XI lists the six materials tested together with the approximate limiting temperatures. The latter are arbitrarily taken as the temperatures at which a 10 percent reduction in strength occurs after 162 hr. of heating. It is quite obvious that the filler plays a major part in determining the limits of serviceability. The organic fillers show a definite deterioration, as exhibited both by a lowering of the strength characteristics and by a visual disintegration of the molded specimen, at much lower (*Please turn to page 126*)



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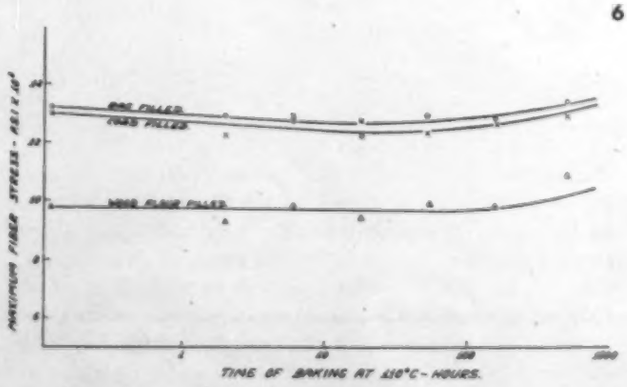


6

Molded plastic-plywood in aircraft[1]

by ROBERT J. NEBESAR[2]

WOOD structures have been used in aircraft since the early days of lighter-than-air machines. Prior to the early '30's, wings of most airplanes were of wood construction, and some of these airplanes are still flying. A little later, wood was introduced for fuselages and tail surfaces also in planes having the more modern stressed skin constructions, such as monocoque or semi-monocoque designs; however, these wooden structures were replaced very soon by parts of metal.

The advantages of wood construction are well known and need not be discussed to a great extent. The most important factor is the strength-weight ratio. Since the weight in aircraft construction is of the utmost importance, it must be considered in relation to the strength. Thus we use the formula for comparing the ratio of strength to weight as given in Table I for tensile and compression values.

The values contained in Table I were established on the basis of 3 sec. duration of stress. Much higher stresses could be carried for shorter duration, as is the case in aircraft stressing where gust, pull-up or landing loads are of the magnitude of a fraction of 1 sec. duration. Furthermore, as aircraft structures are proved by static tests of considerably longer duration of loading, greater margins of safety are obtained. The effect of duration of load on wood structures is shown in Fig. 1.

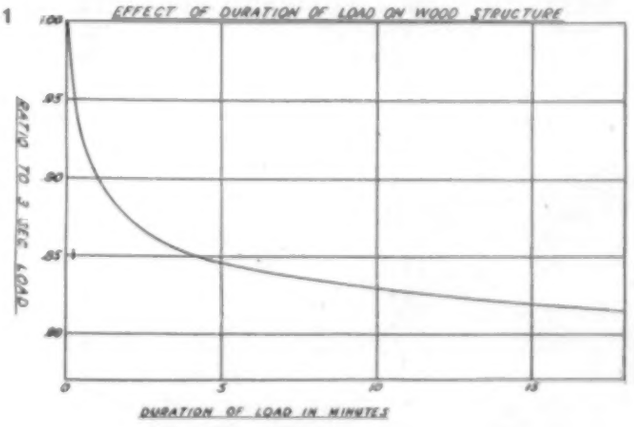
Even though seemingly slightly higher values for ultimate tensile strength to weight ratios can be obtained with special steels or some aluminum alloys, this slight advantage disappears by the necessity of having to make tension joints or connections. In wood constructions, such joints are usually made by gluing without involving any decrease in strength; in metal, joints made by riveting or bolting introduce severe penalties in strength due to decreased sectional areas and due to stress concentrations. Of course, both joints increase weight to some small extent. For strength-weight ratios at yield points, the advantage is chiefly on the side of wood, which is a very important factor so far as rigidity is concerned.

The block compression strength-weight ratios are not very favorable for wood. Since, however, the compressive strength for most airplane structures is considered only as column or panel strength where form factor is so important, the advantage again lies on the side of wood. Since form factors depend mostly on the thicknesses which can be used for the same weight, and since higher thicknesses give greater rigidity, higher stresses can be reached before wrinkling or collapsing. Therefore, panels of longer lengths can be used for wood structures, thus saving in rib or stringer spacing, and hence in both weight and labor. In stressed skin structures, however, this fact is partly outbalanced by the fact that centroids of cross-sectional area in wood structures, due to its greater sizes or thicknesses, are closer to the neutral axis, as shown in Fig. 2. It follows that in order to obtain the best advantages of design for wood construction, the design must be carefully planned and laid out.

Any concentrated loads such as those occurring at fittings of sub-assemblies can easily be handled by laminated attachment blocks. Such construction as shown in Fig. 3 provides for ample direct load distribution to the skin and stringers without any complicated fitting designs.

One of the great features of wood constructions is their faultlessly smooth skins, which stay smooth, and do not wrinkle even under abnormal conditions. This results in greatly increased performance of airplanes so constructed, mainly with respect to speed. (*Please turn to next page*)

1—*Effect of duration of load on wood airplane structures*



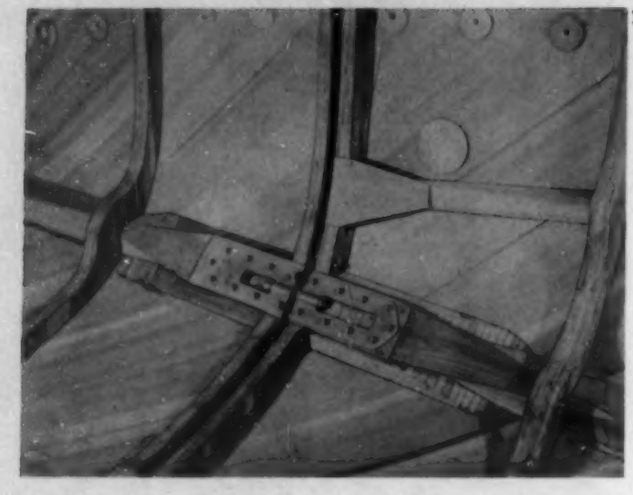
[1] This paper was presented before a joint meeting of the Aviation and Wood Industries Divisions of the American Society of Mechanical Engineers in New York on November 30, 1942, and is published here through the courtesy of that Society.

[2] Universal Moulded Products Corp.

TABLE I.—COMPARISON OF STRENGTH/WEIGHT RATIOS FOR VARIOUS WOODS AND METALS

Material	*Birch*	*Hickory*	*Maple*	*Yellow poplar*	*Spruce*	*Low carbon steel 1025*	*Chrome moly X4130*	*Nickel steel 2330*	*Aluminum 17ST*	*Aluminum 24ST*
Unit wt.—lb. per cu. in.	.025	.030	.025	.016	.016	.283	.283	.286	.101	.100
Ultimate tensile strength, p.s.i.	15,500	19,300	15,500	9,100	9,400	55,000	90,000	120,000	55,000	62,000
Elastic limit (tensile), p.s.i.	9,500	10,600	9,500	6,000	6,200	25,000	50,000	60,000	25,000	32,000
Ratio, UTS/Wt.	608,800	654,000	608,800	561,700	580,200	194,300	318,000	419,600	544,600	620,000
Ratio, EL/Wt.	373,000	359,200	373,000	370,400	382,700	88,300	176,700	209,800	247,500	320,000
Compression strength (‖ to grain for wood)	7,300	8,700	7,500	5,000	5,000	55,000	90,000	120,000	55,000	62,000
Ratio, CS/Wt.	286,700	294,800	294,600	308,600	308,600	194,300	318,000	419,600	544,600	620,000

2



3

2—*In stressed skin structures, centers of mass are nearer neutral axis.* **3**—*Laminated attachment blocks handle concentrated loads at fittings of sub-assemblies*

There have been four major objections to the use of wood in aircraft. Each of these will be discussed and the modern improvements in materials and methods which have overcome these obstacles will be described.

1—Durability

Difficulties were encountered with wood bonded with vegetable or animal glues. These concerned durability—that is, stability under different atmospheric conditions, including dimensional and strength variations with time. This problem was solved with the development of waterproof and boilproof synthetic resin glues. Two basic types are used:

Hot press synthetic resins. Such bonding agents are used at present in the molding process and in the manufacture of plywood. Different types were developed, the major ones being phenolic and urea-formaldehyde resins. Both demand careful control of the mixing of the glue and spreading it, and some control of humidity and temperature conditions.

As an example of such operations, the following are the requirements for a urea-formaldehyde thermosetting resin, P700-2.[3] This adhesive is composed of P700-2A and P700-2B. The former is dissolved in water and stored for 24 hr. at room temperature before mixing with the latter. The two constituents are then mixed in the ratio of 80 parts of P700-2A to 15 parts P700-2B, by weight. The amount of water for 80 parts of P700-2A may vary from 20 to 30 parts. Four days is the useful limit allowed for any given mix of P700-2A solution.

This hot press glue is spread within 4 hr. after mixing at ordinary temperatures. The weight of the wet double glue line may vary from 20 to 40 lb. per 1000 sq. ft., depending upon the application intended. The assembly or lay-up time is much greater than that allowed for spreading. Figure 4 shows the estimated maximum permissible assembly time versus temperature.

On the same curve, the actual working range used by this particular company is indicated by the shaded area in the lower corner of the graph, this indicating the increased safety. It should be noted that the assembly time is defined as the time elapsed between spreading and the application of pressure and heat to form a bond. However, it is to be understood that several variations of this glue have been developed for different production items for operation at different temperatures.

Cold press synthetic resins. These serve mainly in assembly work where molding cannot be used. Here again we will give an example of using a urea-formaldehyde thermosetting glue, P250.[4] This adhesive is obtained in the ready-mixed form which requires only the mixing of dry powdered glue with water in the ratio of 100 lb. of glue to 65 lb. of water. P250 is mixed in quantities of 6 to 10 lb. at a time and stored in a refrigerated compartment. The glue is then distributed in paper cups to the various shops as needed. Fresh glue is mixed every $2^1/_2$ hr. throughout the working day, and all unused glue is discarded at the end of each $2^1/_2$-hr. period. Inert dyes of various colors are mixed with the cold glue as a means of distinguishing the status of the glue with respect to its permissible period of utilization. Actually, the glue-handling procedure outlined above is conservative, as such glue is reasonably safe to use as long as it is spreadable; and it has been verified that by keeping each individual glue cup on ice, the pot life may be extended to about 12 hours.

Cold press glue is allowed an assembly or lay-up time of only 15 min.—that is, the pressure should be applied within 15 min. after spreading. The weight of wet glue line recommended for this type of glue varies from 35 to 40 lb. per 1000 sq. feet.

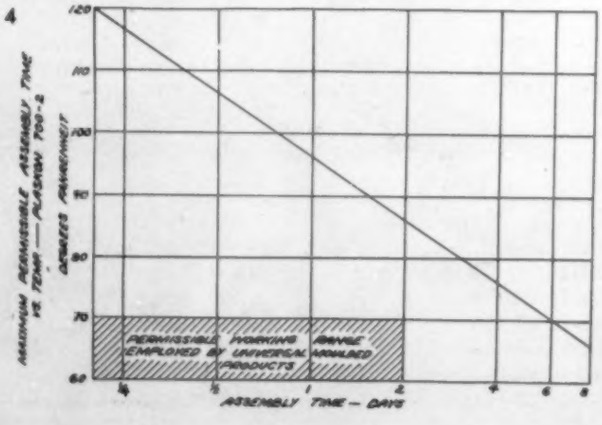
2—Mass production problem

Difficulties were encountered concerning the necessary interchangeability for mass production, especially for aerody-

[3] Plaskon 700-2.

[4] Plaskon 250.

4—*Maximum permissible assembly time vs. temperature*



namically improved designs, enhancing complicated shapes and forms with complex composite double curvatures. Considerable progress in overcoming these difficulties was accomplished by a great advance in molding techniques. Molding plastic-plywood is essentially a process in which a bond is made between pieces of wood, wood veneer or other materials by means of applying fluid pressure and heat of the proper magnitudes through time intervals required to cure the particular bonding agent employed. The molding process is utilized principally in the manufacture of flat plywood for general use, and shaped plastic-bonded veneer structures of composite curvatures for specific uses. For most structures so shaped, other structural components, such as frames, pads and stringers, are molded integrally with the plywood shell in one operation. This particular feature falls under the Vidal patents.

Detailed steps of the molding process include:

a) Spreading of glue on the veneer and/or other pieces to be joined. This is accomplished by glue-spreading machines of different makes and different sheet width capacities. Veneer which has been edge-glued to form sheets of larger sizes is thus limited as to sheet size by the glue-spreader width. Ordinarily, this restriction is of no significance in manufacturing shaped or curved shells for, in such cases, the veneer must be laid or wrapped in relatively narrow strips. It has been found that the double spread method (that is, application of glue to both surfaces to be glued together) is superior to the single spread method. For the components which cannot be accommodated by glue-spreading machines, glue is spread by brush.

b) Veneer-laying or wrapping is, as implied, simply forming the veneer to the mandrel or caul-board on which the plywood component is to be shaped. If stringers, frames, pads, etc., are to be molded to the plywood shell, as is done in the Vidal patents, such parts are inserted in snug-fitting recesses in the mandrel prior to the veneer-wrapping operation, as shown in Fig. 5. Inserted parts are machined to be just a little more than flush with the surface of the mandrel. Upon completion of the molding cycle, the inserted parts have been bonded to the plywood shell to form an integral part of the structure.

In the wrapping of veneer, the various strips are temporarily secured to the mandrel and to each other by staples. Hand-stapling machines are used for this operation. In view of the fact that the mandrels used in the molding process are made of wood, it is necessary to treat their surfaces to prevent bonding between the mandrel and the molded parts in locations where the adhesive can squeeze out. Acetate dope, or sometimes cellophane paper, has been found to be satisfactory for this purpose. In the Vidal patents, male form mandrels are customarily used; in the Duramold process, skins only are molded, using female mandrels so that the outside of the skin will be as smooth as possible.

c) The actual molding or cooking is usually done in autoclaves or pneumatic presses.

The autoclave used is fundamentally a large tank (Fig. 6) with a pressure-tight hinged end of heavy construction. After the veneer has been laid or wrapped on a mandrel, the mandrel is enclosed in a fluid-tight rubber bag and the whole is moved into the autoclave on a small car. The end door of the autoclave is then closed and secured. Hot water and compressed air are then admitted to the autoclave to furnish the heat and pressure necessary to set the synthetic resin bonding agent. The compressed air affords enough pressure to allow the temperature of the water to be raised beyond the normal boiling point without converting to steam. In the proper combinations, the hot water and compressed air give the desired molding temperatures and pressures. The minimum molding pressure and temperature conditions permitted are 50 p.s.i. and 210° F. It is desirable to apply full pressure to the autoclave within 4 min. after the tank temperature reaches 210° F.

The time required to mold any given part depends on the rate of heat penetration through the part. A rule of thumb employed for timing a "cook" in those instances where the thickness of the wood is appreciable is one hour per inch thickness of wood. This rule applies to the usual case where heat is conducted into the work from one side at a much greater rate than from the other. Such conditions arise from the fact that on one side the work being molded is separated from the water in the autoclave only by the thickness of the rubber bag in which the work is enclosed, whereas heat transfer from the other side must take place through bag and mandrel or platen.

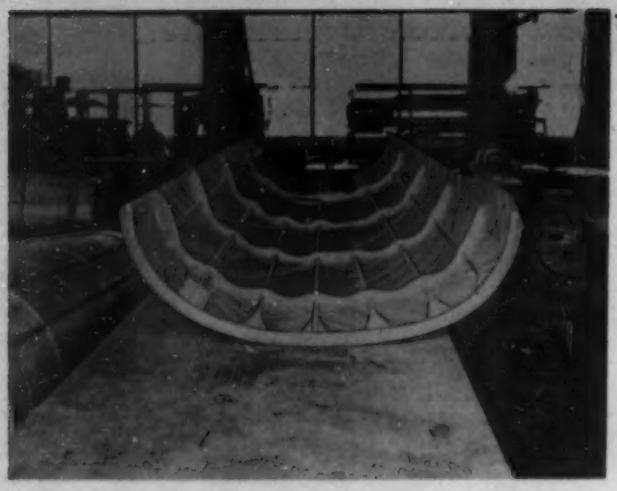
A successful steam-air cooking process has also been conducted. In this process steam and air supplant the water as a source of heat and pressure. Compressed air is used, however, as a supplementary pressure medium to provide flexibility in the pressure-temperature combinations required.

In addition to the autoclaves, pneumatic presses of two types are used to mold smaller parts. As in the autoclaves,

5—If stringers, frames, pads, etc., are to be molded to the plywood shell, they are inserted in the mandrel before veneer is wrapped. 6—The autoclave is simply a large tank with a heavy, pressure-tight hinged end

5

6



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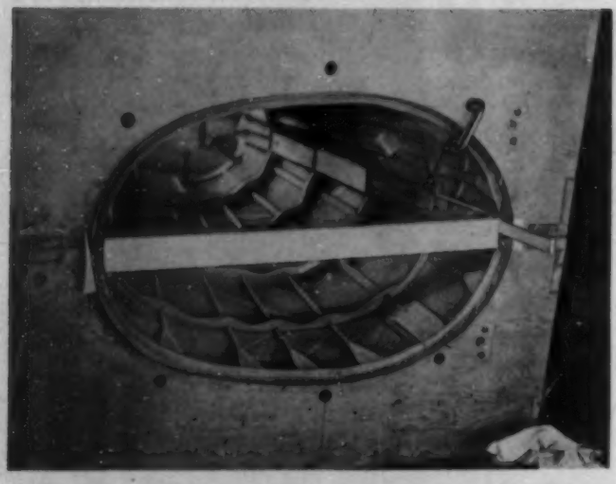

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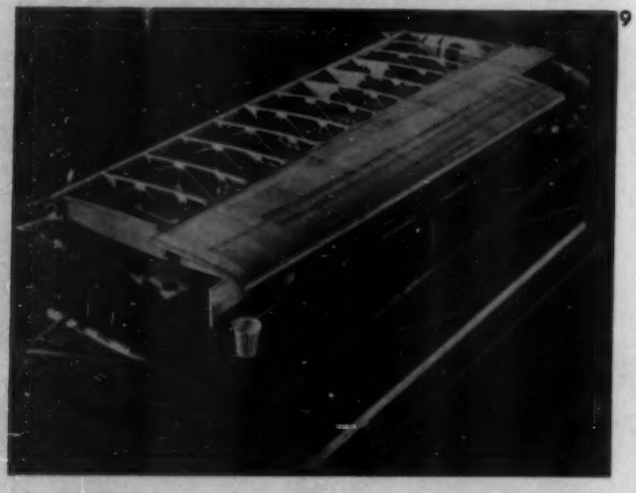


9

7—Molded half of the fuselage after the molding operation. 8—Both fuselage halves in the envelope assembly jig, ready for cold gluing operation. 9—Wing outer-panel section with front portion of molded nose skin

heat and pressure are furnished by steam and compressed air. For the production of small parts, the pneumatic presses are very satisfactory due to the rapidity with which they can be loaded and unloaded.

The use of cold glue at present is an essential complement to the molding processes. Practically all aircraft structural components of any size are molded in halves to facilitate removal from the mandrels. Cold glue operations are employed to assemble such structures. It might also be said with reservation that in all assembly work cold glue processes are employed. Since all assembly work is done with cold glue which itself requires perfect humidity and heat control within fairly close limits, it is here that the interchangeability is achieved. The moisture content of the wood is kept within allowable limits, thus preventing undesirable dimensional changes during fabrication. Of course, all the wood must be properly kiln dried.

3—Weather resistance

Difficulties pertaining to durability under varied climatic conditions were met with in early wooden aircraft, and special finishes have been developed to overcome this fault. The most durable finish is achieved by covering all exterior surfaces by lightweight fabric, such as balloon cloth, which is doped on the surfaces over a special coat of sealer. Several other coats are applied over the fabric which gives the film the required flexibility and elasticity, while the top coats give the weather-resistant durable finish.

Several other types of finish procedures have been developed, giving more or less adequate degrees of protection. For the fabricless type of finishes, it is important to seal exposed end-grain surfaces with adequate sealer compounds and/or to protect them with additional fabric tape. The interior surfaces are usually finished by several coats of phenol-formaldehyde resinous sealers.

4—Weight control

As weight control is most necessary in aircraft construction, the variation in specific gravity of all types of wood species must be given proper consideration. Fortunately it can be stated that the strength properties of woods vary either in direct ratio to the specific gravity or even more rapidly—that is, with higher exponential powers. The pertinent strength data are, therefore, based on the minimum values of specific gravity of species, and for weight calculations somewhat higher values of specific gravity are used. However, in wood in general and in some species in particular, the range of specific gravity is very wide, which would affect the weight to a greater extent than is generally recognized This difficulty can, of course, be overcome by proper specifications and control. In some instances, it was thought necessary to specify also the upper limits of specific gravity for some species.

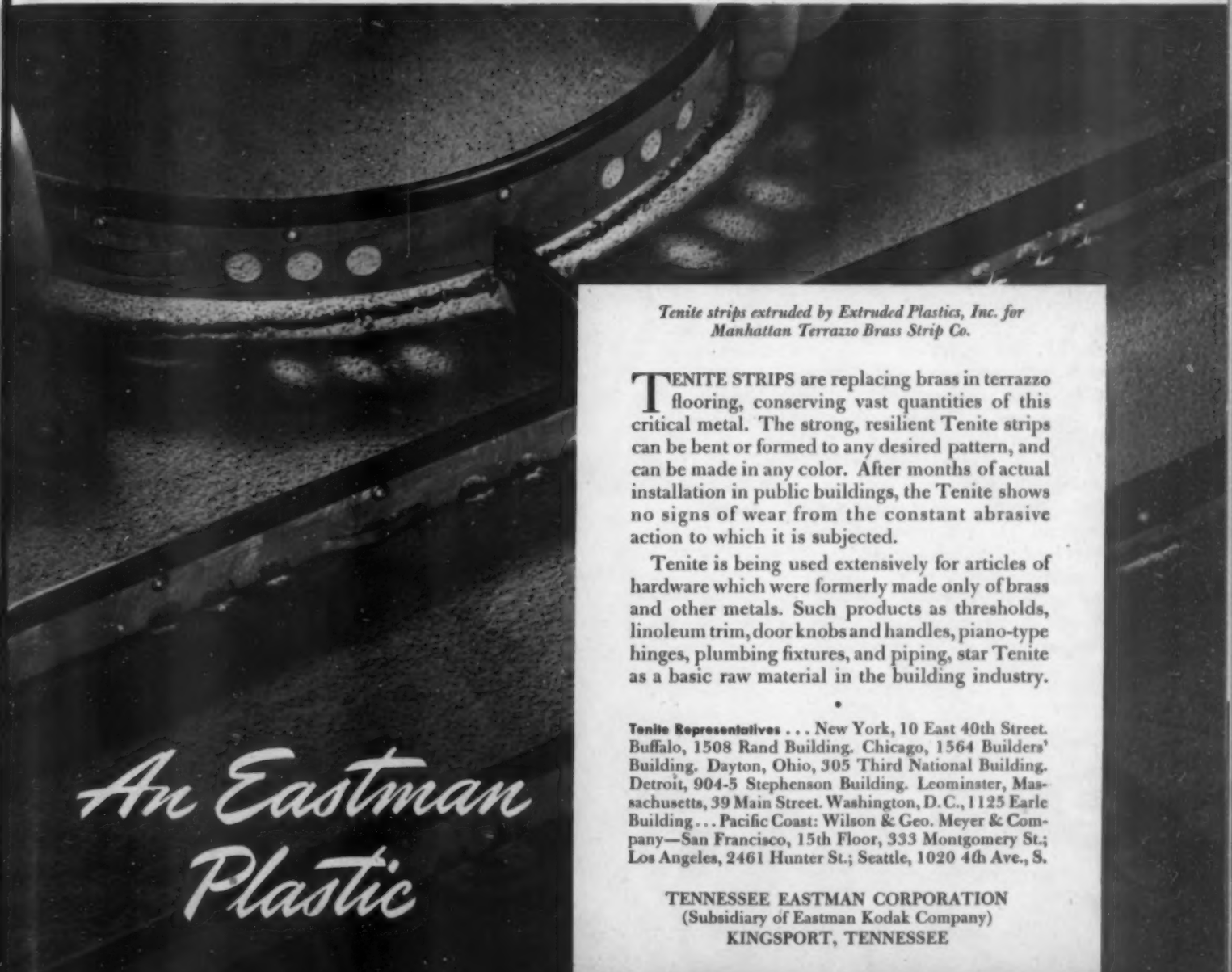
Production items in plastic-plywood

Some examples of molded plastic-bonded veneer and woods are presented.

Semi-monocoque fuselage. The aft section of the XBT-16 fuselage is a semi-monocoque molded plywood construction. In Fig. 7, the molded half of the fuselage is shown as it looks after the molding operation. The spruce longitudinal stringers are standard sections, and the frames are of laminated mahogany. Birch plywood is used in small quantities, principally for reinforcing material. The skin for the fuselage is two-ply poplar with the grains at 45° to the longitudinal axis of the fuselage. In the extreme end base of this fuselage, an additional ply is added to the skin for stiffness. The two halves are assembled in the envelope assembly jig as shown in Fig. 8. A cold glue operation is employed to join the halves by an apron strip. With the installation of fittings and accessories, and after proper finish and painting, the fuselage is complete for final assembly.

Wing outer-panels. The wing outer- (*Please turn to page 116*)

Floor Show... *starring* TENITE



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•

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Ignition points of plastic materials

by JOHN DELMONTE[1] and M. A. AZAM[2]

COMPARATIVE burning rates of plastic materials have been determined both for thin foils and thick sections. In these tests the importance of controlling the technique of igniting the plastic material to determine whether it would support combustion once it has burst into flames has been emphasized. The "fusee" strip for igniting thin foils from a burning piece of cellulose nitrate has proved acceptable, while igniting the plastic material with the aid of a Bunsen burner is used for thicker specimens.

The present investigation has been concerned primarily with determining those specific temperatures at which plastic materials would spontaneously burst into flames. Factors such as burning rate and support of combustion have not been considered.

Method of test

In carrying out these experiments, it was observed that ignition temperatures for the plastics could readily be obtained by determining the temperature at which the plastic material, when placed momentarily in contact with the surface of a mass of a fused, inorganic compound, would spontaneously burst into flames. Experiments were first carried out with an open container of the fused compound heated by a gas flame. This method was modified to provide for heating the fused material in a small laboratory oven, which gave more consistent results.

A schematic diagram of the test oven is shown in Fig. 1. The small nickel crucible holding about 20 grams of the fusible, inorganic compound is placed centrally in an electrically heated oven about 3 in. below the temperature-regulating element. The temperature at the crucible was observed to be about 25° F. below that of the temperature-regulating element for a wide range of temperatures. The reported ignition points are the corrected temperatures of the fused mass in the crucible. The final procedure which was adopted involved raising the oven temperature to some point known to be above the ignition temperature and permitting the oven temperature to fall slowly. At intervals of 25° F., the high-heat switch of the oven control was turned on (this kept the temperature of the open oven substantially constant), the oven door opened, and a specimen of plastic material held in a long pair of tongs was placed in contact with the surface of the molten compound. The effect was observed and the specimen quickly withdrawn. The oven temperature was then allowed to fall to a lower level. The lowest temperature at which spontaneous ignition, as described later, was observed was carefully checked and rechecked.

The inorganic compound selected for the contact mass was sodium hydroxide. This material gave the most consistent results and, in addition, had a desirable melting point and boiling point range for ignition tests, varying from 318° C. to 1390° C. Molten metals did not give such consistent results, tending to accumulate products of oxidation on the surface. The sodium hydroxide was changed after each experiment had been completed.

The plastic specimens were approximately 1/2 in. wide, 1 in. long, and about 1/16 in. thick, though the actual portion making contact with the fused compound was only a small corner. However, these physical dimensions were not critical, since the same ignition temperature range was observed for thick as well as thin specimens of the same material. Likewise, the effect of preconditioning was examined, and no difference was observed in the results for materials conditioned wet when compared with those for materials conditioned dry.

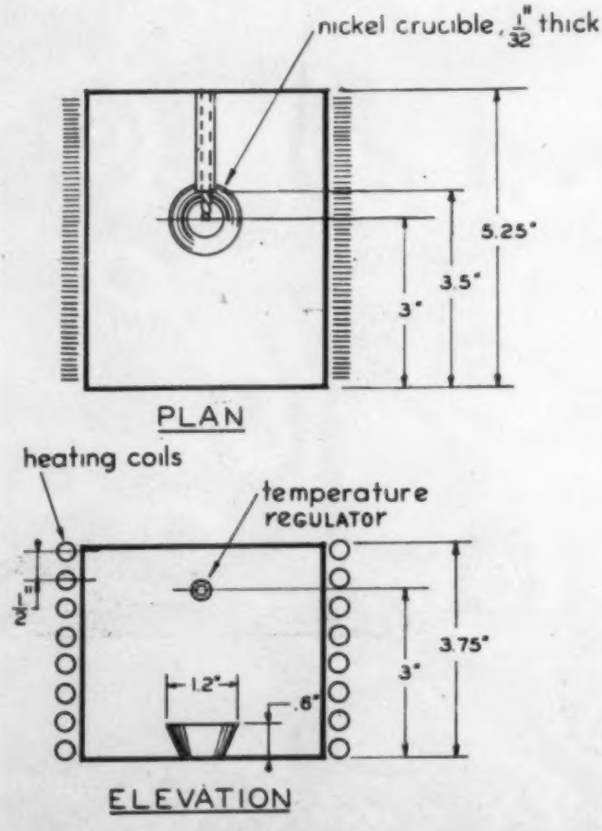
Materials tested

The materials employed in this investigation are listed below, together with their sources:

1. Polystyrene, clear, Lustron, injection molded, 1/8 in. thick, Monsanto Chemical Co.
2. Polyvinyl chloride-acetate, VS3300, green, 1/16 in. thick, Carbide & Carbon Chemicals Corp.
3. Polymethyl methacrylate, clear, 1/16 and 1/8 in. thick, Rohm and Haas Co.
4. Cellulose nitrate, black, 1/16 in. thick, Celanese Celluloid Corp.
5. Cellulose acetate, clear, 1/16 in. thick, Monsanto Chemical Co.

(*Please turn to page 122*)

1



SCHEMATIC DIAGRAM OF TEST OVEN

[1] Technical Director, Plastics Industries Technical Institute.
[2] Plastics Industries Technical Institute.

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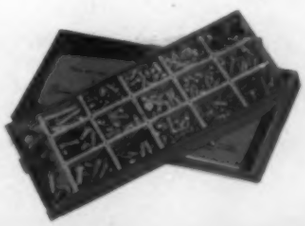

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Plastics Digest

This digest includes each month the more important articles of interest to those who make or use plastics. Mail request for periodicals mentioned directly to publishers

General

SYNTHETIC PLASTICS AND THE TEXTILE INDUSTRY. P. B. Sarkar. Textile Colorist *64*, 530–2 (Nov. 1942). The rôle of plastics in the textile industry, ranging from their use in building equipment to finishing fabrics to obtain special effects, is discussed.

NEW RESIN FOR PAPER MAKING. Paper Trade J. *115*, 14 (Sept. 10, 1942). Melamine resin is recommended for use in paper making. It increases the wet strength, folding endurance, tensile strength, bursting strength and resistance to water penetration. Simplicity of application is another advantage.

LOW-COST DIES FOR AIRCRAFT PARTS. Benhardt Schlenzig. Am. Machinist *86*, 1307–14 (Nov. 12, 1942). Forming and bending dies made of plastic and semi-plastic materials, such as phenolic plastics and Masonite, can be used to shape sheet metal parts, particularly those made of aluminum and magnesium alloys, employed in airplane construction. The type of die used at the Naval Aircraft Factory is described and several sketches are given.

STANDARDIZATION OF PLASTICS IN GERMANY. Plastics *6*, 442–3 (Dec. 1942). A brief note on current standard specifications for plastics employed in the electrical industries.

Materials

A NEW WOOD MATERIAL—HYDULIGNUM. British Plastics *14*, 381–4 (Dec. 1942). Hydulignum is made of 0.028 in. thick birch veneers impregnated with vinyl formal resin and compressed 60 at a time into a board 1.25 in. thick, employing first flatwise compression and then sidewise compression. It is used in the construction of aircraft propeller blades. This material and process are said to result in blades of greater stiffness, more uniform in density, with vibration dampened down and the tendency to flutter reduced, and usable in thinner sections. The choice of vinyl formal resin was based on its high temperature softening point, lack of brittleness at low temperatures and extreme toughness and durability.

FORMVAR BONDS FOR AIRSCREWS. Plastics *6*, 425–7 (Dec. 1942). The following values are cited for the mechanical properties of Hydulignum: specific gravity 1.31; tensile strength 45,700 p.s.i.; compressive strength 21,000 p.s.i.; shear strength L.T. 4540 p.s.i.; shear strength L.N. 4480 p.s.i.; modulus of elasticity 4×10^6 p.s.i.

PROPERTIES OF SYNTHETIC RUBBER. Oil and Gas J. *41*, 81–90, 106–10 (Nov. 26, 1942). The properties of the various synthetic rubbers are compared. These include, among others, chemical structure, resistance to chemicals and heat, aging, electrical properties, mechanical properties, effect of high and low temperatures and x-ray patterns. Many of the superiorities and applications of the various rubbers are discussed.

DERIVATIVES OF STARCH. IV. PLASTICIZATION STUDIES OF STARCH TRIACETATE FILMS. C. A. Burkhard and E. F. Degering. Rayon Textile Monthly *23*, 80–2 (Nov. 1942). The solubility and compatibility of 105 plasticizers with low and high viscosity starch triacetates are reported. Data on the plasticizer retention of 48 compounds are also given. The results are summarized as follows: (1) naturally occurring vegetable oils do not dissolve starch triacetates; (2) low molecular weight esters are excellent solvents; (3) high molecular weight esters are poor solvents; (4) high viscosity compounds have a low rate of solution; (5) the loss in weight by heating is higher for starch triacetate films than for cellulose acetate films; (6) the loss in weight by leaching is higher for starch triacetate films than for cellulose acetate films; (7) starch triacetate films become opaque and brittle on leaching.

Molding and fabricating

ELECTROSTATIC HIGH-FREQUENCY HEATING MAKES POSSIBLE MANY NEW DESIGNS. Product Eng. *14*, 40–3 (Jan. 1943). The electrostatic high frequency method of heating plastic materials during their forming operations is described in detail. The materials to be molded are placed between metal plates in a press and an electrical potential of several thousand volts at a frequency of 1,500,000 to 10,000,000 cycles per second is applied. This results in uniform heating of the non-electrical conducting materials. Installations with capacities less than 15 kva are furnished with the electrical equipment in a convenient cabinet. A laminated sheet made from 148 birch veneers bonded with phenolic resin by this method had a tensile strength of 45,000 lb. per sq. inch. Several applications and data on some of the plastic materials molded by this heating process are given. Some of the advantages claimed are 1) uniform heating which results in improved quality, 2) faster production, 3) reduced labor costs, 4) greater flexibility in operation of equipment and 5) better heat control.

Applications

PLASTICS IN ASSEMBLED BUILDING STRUCTURES. G. Fejer. Plastics *6*, 396–407, 444-54 (Nov. and Dec. 1942). Suggestions are given for the prefabrication of kitchen and bathroom units, etc.

POLYVINYL ACETATE ADHESIVES. E. E. Halls. Plastics *6*, 431–5 (Dec. 1942). The physical character and behavior of polyvinyl acetate adhesives under test conditions of varying temperature and humidity are reported. Comparative tests with adhesives based on chlorinated rubber, glyptal resin and oil-modified glyptal resin were made. Phenolic laminates, plywood, rubber and brass were used in these adhesion tests.

WATERPROOF AND WATER REPELLENT FINISHES. P. Wengraf and E. W. K. Schwarz. Am. Dyestuff Reporter *31*, 551–7 (Nov. 9, 1942). The history of waterproof and water repellent finishes for fabrics is reviewed. Present day finishes fall into four groups: 1) fatty and resinous insoluble substances applied mechanically, 2) metallic soaps, 3) synthetic resins and 4) chemically changed fibers. Methods of testing are discussed. It is concluded that the fabric of the future may be made of synthetic fibers with all the desired properties incorporated. This would result in abolishing many of the treatments now applied to woven fabric.

Coatings

CELLULOSE ACETATE CABLE LACQUERS. H. W. Rudd. Paint Manuf. *12*, 2–4 (1942). Good cable lacquers dry quickly, are nonflammable, are resistant to heat, water, gasoline, oil and ozone, are flexible at low temperatures and retain their insulating properties under these conditions. The test methods used to evaluate cable lacquers are described. The most useful solvents for cellulose acetate cable lacquers are methyl acetate, acetone and methyl ethyl ketone. Phthalic acid esters are best plasticizers.

WATER EMULSION PAINTS. W. H. Butler. Canadian Chem. and Process Ind. *26*, 612–14 (Oct. 1942). Resins suitable for making water emulsion paints are described. They are oil-reactive ester resins made from bicyloheptene dicarboxylic acid or similar types. The low-polymer esters react with drying oils when heat-processed to produce copolymers. The processing of these resins with oils emulsifying agents and stabilizers is described. These resin emulsions are easily made, are stable to dilution, to heat and to cold, and can be mixed with pigments. The air dried films have good water and weathering resistance and no surface shrinkage on drying.

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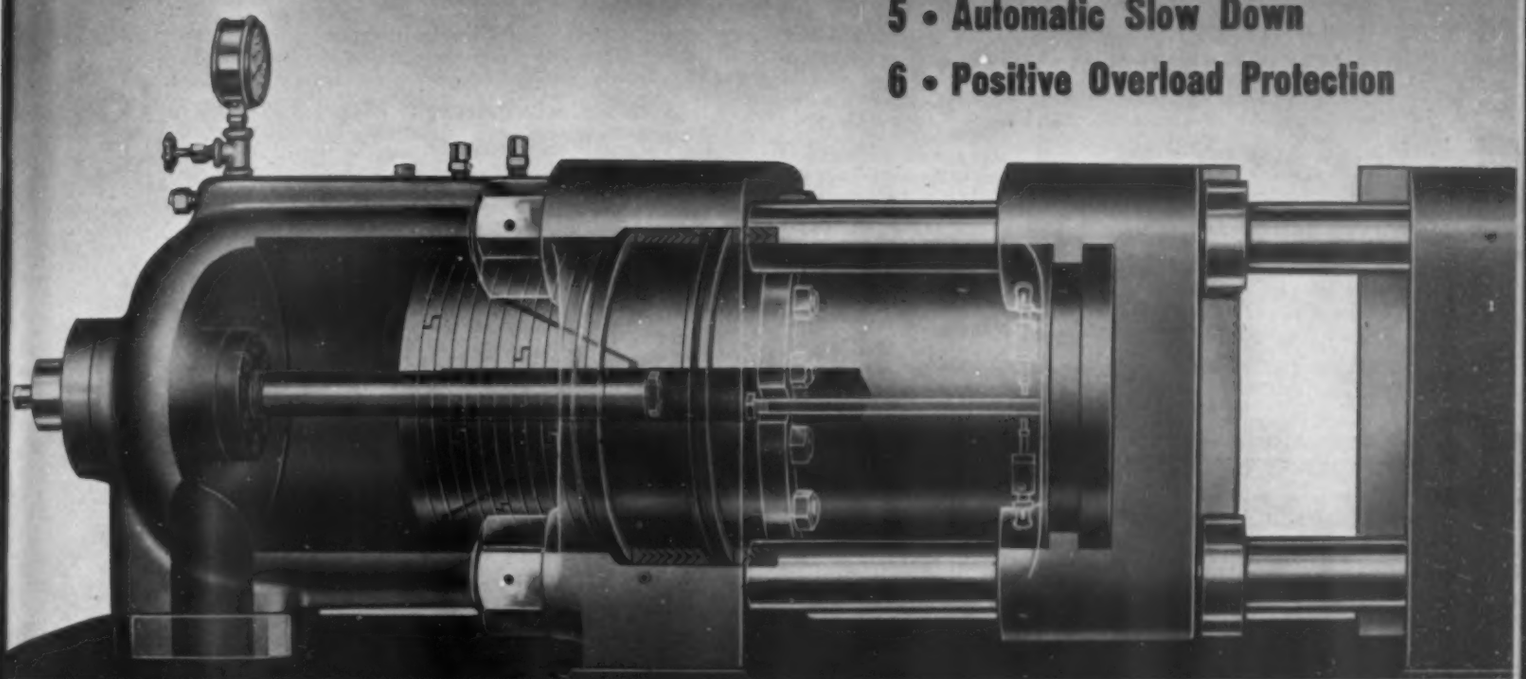

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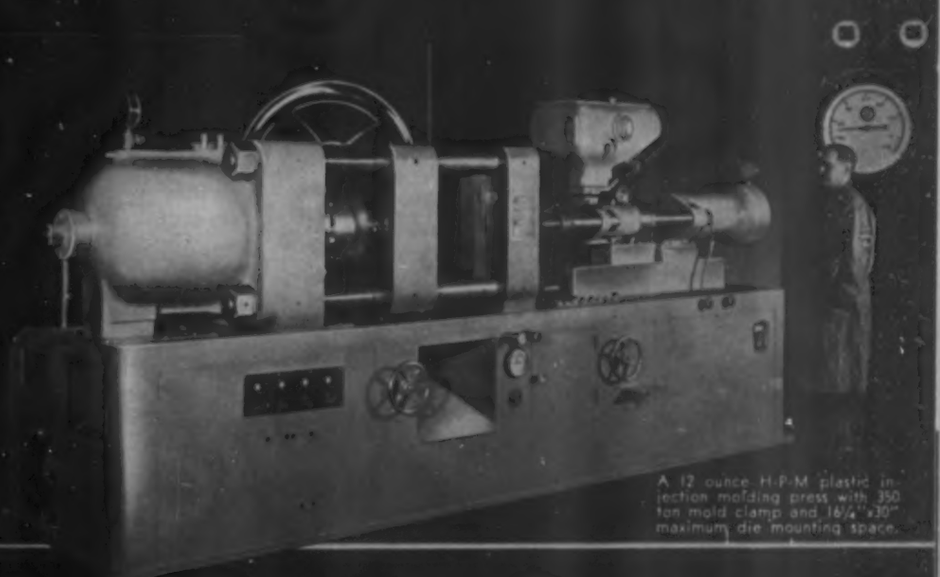

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U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each

INSULATING BUSHINGS. I. W. A. Kirkwood and P. D. Ritchie (to A. Reyrolle and Co., Ltd.). U. S. 2,303,283, Nov. 24. Forming a support of organic polymer fibers including a stress-grading layer, impregnating the support with a liquid monomer and polymerizing the monomer to agglomerate the support into a bushing for electrical conductors.

CASTING PLASTICS. N. Lester (to Lester Engineering Co.). U. S. 2,303,288, Nov. 24. A pressure casting machine having a reciprocating ejector operating in the casting cylinder.

SHAPED ARTICLES. H. Dreyfus (to Celanese Corp. of America). U. S. 2,303,339–40, Dec. 1. Melting a synthetic thermoplastic film-former under water, injecting a plasticizer, mixing it thoroughly with the thermoplastic and molding the product under water; and forming filaments, foils or films by extrusion of a molten fiber-forming plastic through a suitable orifice.

LIGNOCELLULOSE PLASTIC. W. H. Mason and R. M. Boehm (to Masonite Corp.). U. S. 2,303,345, Dec. 1. Impregnating chips with a salt of a weak acid, steaming under pressure and exploding the steamed material to produce fine particles, and molding into boards in presence of plasticizer.

RESIN-FACED PANELS. O. R. Schultz and H. D. Tucker (to Cellu-Type Plate Co., Inc.). U. S. 2,303,395, Dec. 1. Facing fibrous board with a thin layer of cold-moldable resin and embossing a design therein to make decorative panels.

RIGID SHAPES. K. Clark (to American Seal-Kap Corp.). U. S. 2,303,436, Dec. 1. Impregnating paper with a dispersion of urea resin and stiffening agent and cold-molding to form rigid shaped articles.

TEXTILE FINISH. W. J. Thackston (to Rohm and Haas Co.). U. S. 2,303,773, Dec. 1. Treating textiles with a composition containing an alkyd resin modified with a nondrying oil.

RESIN SHEETING. J. M. De Bell (to Monsanto Chemical Co.). U. S. 2,303,826, Dec. 1. Tacky vinyl resin interlayers for safety glass are protected from premature sticking by means of fabric coated with cellulose acetate, regenerated cellulose or a thermosetting resin.

RESIN SHEETING. E. R. Derby (to Monsanto Chemical Co.). U. S. 2,303,828, Dec. 1. Vinyl resin interlayers for safety glass are interleaved with a cellulosic plastic (having a fine grain matte surface) to prevent premature sticking.

METALLIZING PLASTICS. B. F. Walker (to Metaplast Corp.). U. S. 2,303,871, Dec. 1. Metallizing organic plastic surfaces with ammoniacal silver nitrate solution and a reducing agent after pretreatment with acid stannous chloride solution.

MOLDING POWDER CONVEYOR. G. B. Sayre (to Boonton Molding Co.). U. S. 2,303,957, Dec. 1. A conveyor for transferring thermosetting molding powders has a horizontal arm and a vertical arm.

AMMUNITION BELT GUIDE. P. J. Bawcutt and G. C. Brentnall (to Dunlop Rubber Co., Ltd.). U. S. 2,303,976, Dec. 1. A guide for machine gun ammunition belts has two extruded thermoplastic channels, connected at intervals by plastic-covered metal strips.

ADHESIVE. A. Brookes (to American Cyanamid Co.). U. S. 2,303,982, Dec. 1. Impregnating a cellulosic filler with benzyl alcohol and adding it to an aqueous urea resin adhesive.

METAL INSERT. J. B. Tegarty (to Standard Products Co.). U. S. 2,304,036, Dec. 1. Metal inserts for thermosetting plastic articles are provided with teeth behind which plastic is caused to grip insert by cold flow.

MOLDING MACHINE. L. V. Bergmann (to Armstrong Cork Co.). U. S. 2,304,141, Dec. 8. A molding machine having a pair of cooperating mold elements mounted on a rotating carrier, one being movable in a cylinder bore under hydraulic pressure.

LENSES. E. D. Tillyer (to American Optical Co.). U. S. 2,304,217, Dec. 8. Molding plastic lenses in a sealed chamber under sufficient fluid pressure to retard vaporization.

POWDERING PLASTICS. J. F. Walsh (to Celanese Corp. of America). U. S. 2,304,221, Dec. 8. Reducing plastics to a fine powder by brushing particles from a thin layer of the plastic into a chilling medium.

HEAT INSULATION. Wm. M. Bergin and Allen L. Simison. U. S. 2,304,233, Dec. 8. Spraying a mat of mineral fibers, during its formation, with a partially condensed thermosetting resin and a lubricant, and curing the resin to form heat insulation panels.

ADHESIVE FILMS. W. Lüty (to Licoro Corp.). U. S. 2,304,263, Dec. 8. Making reinforced sheeted adhesives by coating a perforated metal sheet with a liquid phenol-formaldehyde condensation product, to form a sheet which can be stored and later used in plywood.

SLIDE FASTENERS. G. Dahlin (to Lightning Fastener Co., Ltd.). U. S. 2,304,340, Dec. 8. Lock sliders for slide fasteners are molded in a mold cavity containing a resiliently deformable track as an insert.

PHENOL-FORMALDEHYDE REACTIONS. J. F. Walker (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,304,431, Dec. 8. Using trioxane, with a depolymerization catalyst, as the source of formaldehyde in reactions with phenol.

INJECTION MOLDING. E. R. Knowles (to Watson-Stillman Co.). U. S. 2,304,461, Dec. 8. A machine for molding wheel rims by the injection method.

POLYSTYRENE. L. A. Matheson, R. F. Boyer and J. L. Amos (to Dow Chemical Co.). U. S. 2,304,466, Dec. 8. Stabilizing styrene type polymers with a small proportion of a polyhydric phenol.

DRINKING STRAWS. S. T. Maltby (to Stone Straw Corp.). U. S. 2,304,467, Dec. 8. A machine for forming and bending plastic straws.

PRINTING PLATE. Thos. R. Caton. U. S. 2,304,541, Dec. 8. Making photo offset printing plates from hardened cellulose acetate or nitrocellulose.

POLO MALLET. Jacques S. McMinn. U. S. 2,304,585, Dec. 8. Nonsplintering polo mallet heads are formed by dipping wood heads in a Celluloid solution and wrapping the coated head, before it dries, with tape impregnated with a phenol-aldehyde resin.

ADHESIVES. H. Scheuermann (to Plaskon Co., Inc.). U. S. 2,304,600, Dec. 8. Condensing urea or thiourea with formaldehyde and adding a diamine to form a viscous water-soluble product.

PLASTIC BINDINGS. C. E. Emmer (to General Binding Corp.). U. S. 2,304,629, Dec. 8. Apparatus for forming plastic bindings on an arbor attached by a rotatable support to a movable carriage; and a machine for opening plastic bindings.

PEBBLED FINISH. C. R. Faelten (to Flood and Conklin Mfg. Co.). U. S. 2,304,632, Dec. 8. Imparting a knurled or pebbled finish to injection moldings by wetting the surface with a solvent and allowing it to evaporate.

ANION EXCHANGE. V. R. Hardy (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,304,637, Dec. 8. A resin which is capable of anion exchange is made by reacting a halide polymer resin with an amine.

MOLDING LENSES. C. V. Smith and F. P. Williams; C. V. Smith (to Univis Lens Co.). U. S. 2,304,663; 2,304,664, Dec. 8. Forming a lens by preheating a resinous blank and a mold to the same temperature, then applying pressure to the mold; and a lens forming press having a forming die carried by a stationary head.

CONTAINERS. K. Bratring (to Neocell Products Corp.). U. S. 2,304,676, Dec. 8. Forming containers by dipping a core into a film-forming bath until a comparatively rigid shell is obtained.

RESINOUS POLYMERS. Max Hagedorn (vested in the Alien Property Custodian). U. S. 2,304,687, Dec. 8. Resins which are soluble in hot methanol are made from a polycarboxylic (at least tricarboxylic) aliphatic acid and an *omega*-amino acid with chain length at least 6.

STABILIZER. R. F. Boyer and L. C. Rubens (to Dow Chemical Co.). U. S. 2,304,728, Dec. 8. Stabilizing styrene type resins with a dihalonitrophenol or a halodinitrophenol.

PHENOLIC AMIDE RESIN. H. A. Bruson (to Resinous Products and Chemical Co.). U. S. 2,304,729, Dec. 8. Heating a polycarboxylic acid anhydride with a tertiary aminomethyl phenol to form a resin.

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Technical Briefs

Abstracts of articles on plastics in the world's scientific and engineering literature relating to properties and testing methods, or indicating significant trends and developments

Engineering

PLASTIC AXLEBOX BEARINGS. Railway Gazette *1942*, 290 (Sept. 25). Although the incidence of hot boxes has been greatly diminished, and by the use of roller bearings virtually eliminated, the phenomenon is still not unknown, and it is in this direction and down the avenues of reduced weight and cost that engineers must look for improvements in the present types of railway axleboxes. Plastic bearings have already been tried for rolling-stock plain bearings in Europe with encouraging results. The material used was of laminated textile sheets impregnated with cresol resin having a resin content of 65 percent. The greatest single factor leading to successful performance was a highly polished surface at the beginning of the service period. This was attained by a running-in period before the vehicle was sent out of the shops. The outermost layer of the plastic bearing was removed and polished by running on a special mandrel having the same diameter as the journal. Before this outer layer was removed the friction was enough to make the bearing seize at a pressure (load ÷ journal diam. × length) of 400 p.s.i. After polishing, pressures of 1000/1200 p.s.i. were carried satisfactorily at peripheral speeds up to 3.25 ft. per sec., and with a bearing temperature of 70° to 75° C. at that speed.

THE WELDING OF THERMOPLASTICS. I. DEVELOPMENT OF WELDING METHODS. A. Henning. Kunststoffe *32*, 103 (Apr. 1942). Sheets of polyvinyl chloride, 8 mm. thick, were welded together by means of welding thread. Two types of thread were used, one without plasticizer, the other with 10 percent plasticizer. The tensile strength in kg. per sq. mm. of the original sheet ranged from 2.9 at 60° C. to 8.9 at −30° C.; that of the sheet welded with thread without plasticizer ranged from 2.8 at 60° C., to 5.1 at 14° C., to 4 at −30° C.; that of the sheet welded with thread with 10 percent plasticizer ranged from 2.8 at 60° C., to 2.6 at 2° C., to 4 at −11° C., to 5.1 at −30° C. The elongation ranged from 80 percent at 60° C. to nearly 0 percent at −20° C. for the original sheet, from 7 percent at 60° C. to nearly 0 percent at 35° C. for the sheet welded with thread without plasticizer, from 70 percent at 60° C. to nearly 0 percent at −20° C. for the sheet welded with thread with 10 percent plasticizer. Data are given on the influence of the welding atmosphere, of tempering of welds, and of acids and base on the strength of the weld.

VALVES IN POLYVINYL CHLORIDE. Plastics *6*, 340–344, 380–383 (Oct. and Nov. 1942). The important part played by welding and hot forming in the production of polyvinyl chloride valves for chemical plants is emphasized; also the design, assembly, and uses.

Chemistry

CATALYZED POLYMERIZATION OF METHYL METHACRYLATE IN THE LIQUID PHASE. R. G. W. Norrish and R. R. Smith. Nature *150*, 336–7 (Sept. 19, 1942). Methyl methacrylate was polymerized slowly at 60°, 40° and 25° C. with benzoyl peroxide catalyst in various solvents. Results are given in tabular and graphic form. Up to a certain stage, the influence of all solvents on the rate of polymerization was similar, but beyond this stage, the rate of reaction rose in a specific manner. With the poorer solvents, the rise in polymerization rate was more marked and occurred earlier, and the chain length of the polymer was greater.

ANALYSIS OF CELLULOSE DERIVATIVES. C. J. Malm, L. B. Genung and R. F. Williams, Jr. Ind. Eng. Chem. Anal. Ed. *14*, 935–40 (Dec. 1942). A method for the determination of free or unsubstituted hydroxyl groups in cellulose derivatives has been developed, which makes use of acetic anhydride in pyridine reagent of Verley and Bölsing. Acetylation at 75° to 80° C. for about 24 hr. using 0.5-molar reagent in generous excess gave results on the samples of cellulose acetate, acetate propionate and acetate butyrate tested, which agreed well with hydroxyl values calculated by difference from the acyl analyses. The effects of time, temperature, anhydride concentration and excess were studied and optimum ranges for each were established. Most commercial cellulose esters have essentially three replaceable hydroxyl groups per glucose unit of cellulose, but certain very low viscosity samples contain more than 3 hydroxyls and the deviation from 3 may be used for the calculation of an average degree of polymerization of such samples. Equations and graphs are presented by which percent hydroxyl can be converted to hydroxyls per glucose unit of cellulose.

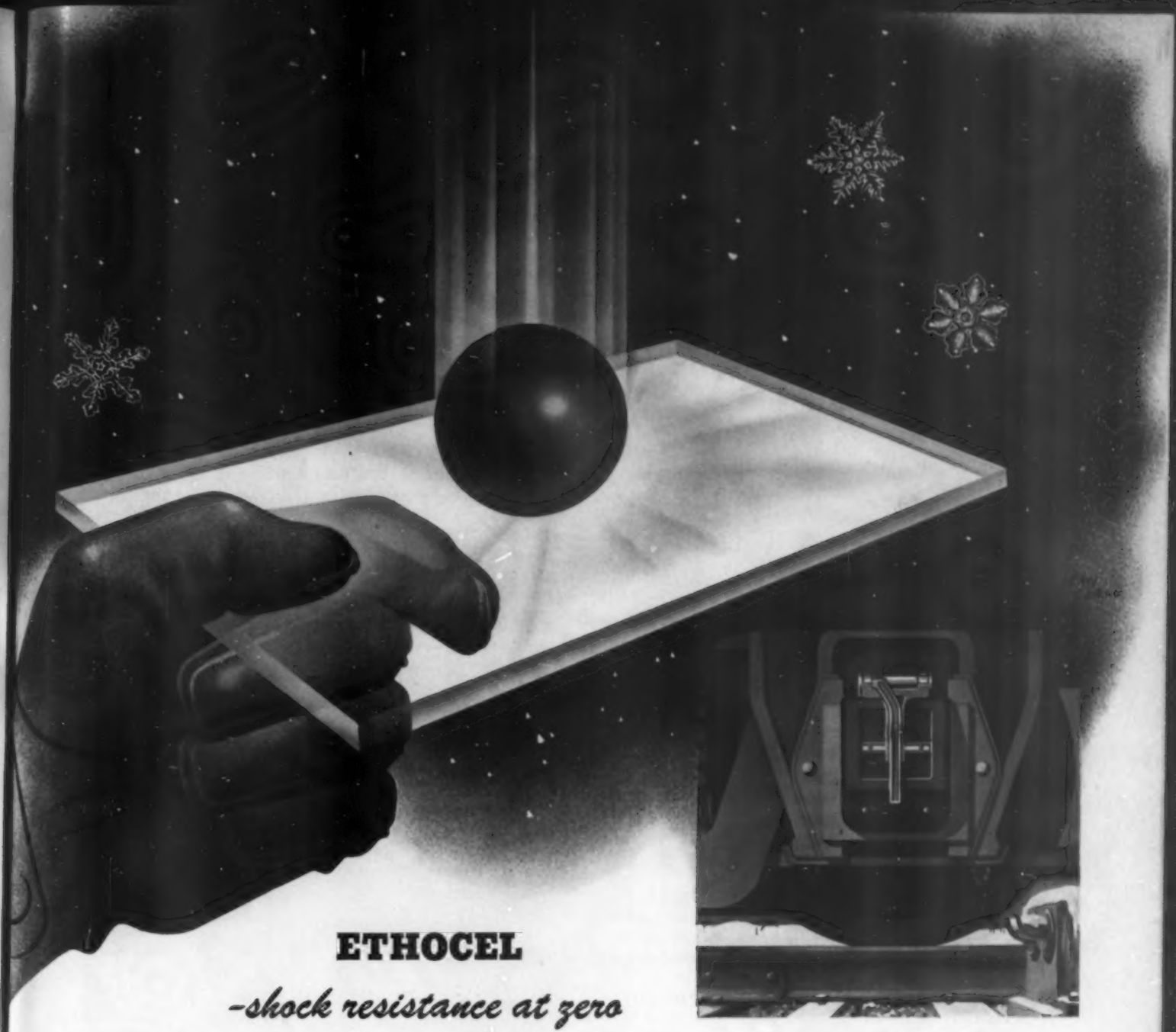
Properties

ABRASION RESISTANCE OF FLEXIBLE VINYL PLASTICS. F. W. Duggan. Product Eng. *14*, 45–9 (Jan. 1943). The abrasion resistance of various vinyl plastics, rubber and leather was determined on a modified Kelly-Springfield abrasion testing machine. The vinyl plastics included two types of vinyl chloride acetate copolymer and a vinyl butyral resin combined with 4 plasticizers. The constancy of abrasive surfaces and the effect of the type of abrasive surface, of abrasion clearance settings, of shoe pressure, of temperature and of specimen thickness were investigated. The abrasion loss of most of the plasticized vinyl resins was better than that of rubber and synthetic rubber beltings, and than that of shoe sole materials and leathers.

EFFECT OF CURE ON THE PROPERTIES OF UREA-FORMALDEHYDE MOLDINGS. J. Hofton. British Plastics *14*, 350–352 (Nov. 1942). Data are tabulated on the variation of water absorption, tensile strength, flexural strength, impact strength and surface resistivity for various curing times and temperatures of urea-formaldehyde moldings. Variation in mechanical properties of moldings which have been cured so as to just pass the boiling test and those which had a 30 percent longer cure are small. The molding after 10 min. immersion in boiling water should show no surface attack and be resistant to scratching with the finger nail; if the piece is exceptionally thick, it should be cut through before boiling. An undercured piece will be scratched with the finger nail and an overcured piece will show surface attack or even disintegrate.

STRENGTH OF COMPOUND MOLDED PLASTICS H. R. Jacobi. Kunststoffe *32*, 1 (Jan. 1942). The impact and bending strengths of compound molded phenolic plastics, combinations of laminated and non-laminated compression molded materials, were measured. The fillers in the phenolic plastic components used to make the compound materials were as follows: laminated cellulose, short fibered cellulose, cellulose shreds and shredded textile fabric. The test sheets were made in three layers; a central layer of one material and the two outer layers of a different material. When the stress was applied parallel to the layers, a large reduction in strength resulted when a small portion of non-laminated plastic was used in the compound structure. When the stress was applied perpendicular to the layers, a large reduction in strength resulted when a small portion of non-laminated material was used in the outer layers or on the side of the bar which was in tension. The decrease in strength was slight when the stress was applied perpendicular to the layers of a compound material in which the laminated portion was in the outer layers or on that side of the specimen which was in tension.

COLOR MEASUREMENTS ON SYNTHETIC RESINS. O. Schäfer. Kunststoffe *30*, 4–9 (1940). The color stability of urea, phenolic, aniline and casein resins was investigated. When a mercury quartz lamp was used, the urea and casein resins were practically light stable while the others showed considerable color changes. Color changes were greatly accelerated by, ultraviolet light, while visible blue light had a greater effect than yellow light.



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Typical new development in the use of Ethocel is this test journal box cover—designed to replace cast iron when Ethocel is again available for this type of application. Results show it is tough and durable, yet flexible. It effectively protects the axle bearings from dirt, dust, snow and moisture.

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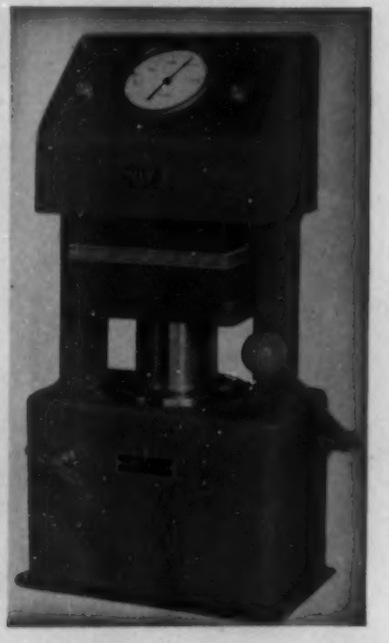
Machinery and equipment

★ A HARDSTEEL REAMER, CLAIMED TO BE CAPABLE of reaming steel of any degree of hardness without annealing, has recently been developed by the Black Drill Co., 5005 Euclid Ave., Cleveland, Ohio. The manufacturer reports that this unit has been used on carburized, oil-hardened, water-hardened, cyanided and nitrided pieces of high carbon, high chrome and high-speed steel.



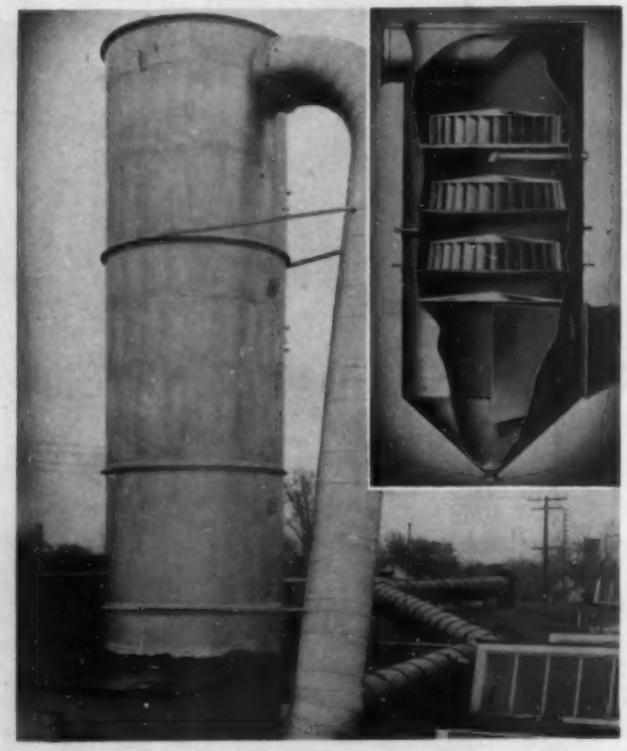
★ FEATURES OF A MUCH LARGER PRESS FOR LAMInating and laboratory work have been combined in Preco, recent development of Kingsbacher-Murphy Co., Los Angeles, Calif. This compact press (above), standing only 27½-in. high with 8-in. by 8-in. platens, has a pressure range from 0 to 40,000 lb. and is claimed to maintain accurately any pressure point within its limits for several hours. A 750-watt heating element, cast into both upper and lower platens, is controlled by adjustable thermoswitches and separate pilot lights. Water cooling coils, also cast into each platen, may be adjusted as desired. The oil reservoir and pump unit, which is a hydraulic two stage, dual stroke type, is sealed in.

★ A FULLY HYDRAULIC PRESS DESIGNED BY ITS makers specifically for war industry, but said to have broad industrial application, is announced by Hydraulic Machinery, Inc. The specifications read in part: 25 ton pressure; 30 in. stroke; 60 in. of daylight; 25 in. from floor to platen; 18 in. by 18 in. platen; combination pump, relief, check and unloading valve; 7½ h. p., 1200 r.p.m.; manually operated control valve which controls the direction of the ram. The press is constructed of welded steel, mounted on a flared base 30 in. by 30 in., and has an overall height of 139 inches.

★ HEAVY SPLIT LEATHER THUMB AND FOREFINGER units with lastex backing afford protection to the wearer in hazardous industrial operations. Fashioned to be worn separately or under standard gloves, these finger guards, from Industrial Gloves Co., Danville, Ill., are also available in kid leather or wool felt.

★ ELASTIC STOP GANG CHANNEL NUTS FOR INdustrial use where a multiple, self-locking, bolted fastening is required are offered by the Elastic Stop Nut Corp., Union, N. J. The strips of nuts are factory assembled, and can be riveted or fastened to the structure on which they are to be used. They consist of specially designed Elastic Stop nuts with four lugs at the base, installed at specified intervals in a metal channel strip which is preformed to accommodate the nut lugs under longitudinal flanges. The channel strip is pierced for the required nut size and spacing, and the nuts are held in place by depressions in the channel.

★ A PORTABLE, MOTOR-DRIVEN TEST PUMP IS manufactured by Watson-Stillman Co., Roselle, N. J., for use in testing boilers, tubing and various types of high-pressure vessels. The pump is a three-plunger vertical unit, and all parts are enclosed for protection against foundry sand and other air-borne abrasives. The equipment includes pressure gage, safety valve, needle valve for pressure regulation, motor, motor starter, disconnect switch, and 25 ft. rubber cable.



★ A UNIT TYPE DUST COLLECTOR (ABOVE) MANUfactured by Claude B. Schneible Co., Chicago, Ill., offers suitable application to both large and small plants. The collector, pictured installed and in cross section, is welded of heavy gage steel, has two and a half impingement stages, an effective entrainment, and inspection openings. The fan, of heavy duty centrifugal blower type, is protected from corrosive elements by the air being thoroughly washed before reaching it from the collector outlet. The automatic sludge ejector eliminates cleaning. A vertical submerged type pump is direct connected to the motor with removable liners and outside packing gland. The unit is easy to install. Shutdowns are said to be unnecessary.

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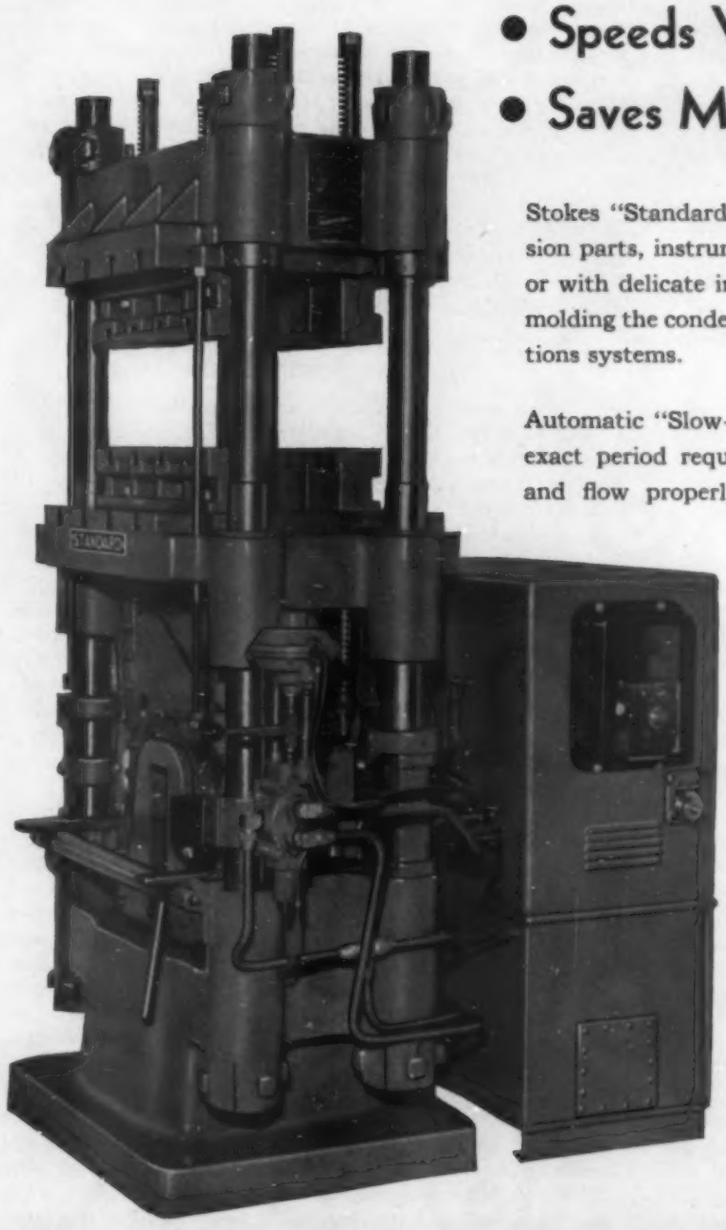

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Improved Stokes "Standard" Presses are proving their advantages in war work of many kinds. These advantages will prove of equal value in the post-war economy. for more information write for new Catalog No. 427.

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Washington Round-Up

Current news, Government orders and regulations affecting the plastics industry, with analyses of the plastics situation

VOLUNTARY RENEGOTIATION OF WAR CONTRACTS

(This article was prepared exclusively for MODERN PLASTICS *by Albert J. Browning, Colonel, General Staff Corps, U. S. Army.)*

War contractors are now quite generally familiar with the fact that all contracts of $100,000 or more are subject to review for the purpose of determining whether excessive profits have been resulting, or probably will result. But contractors are in many cases undecided as to the best way to proceed. Should they voluntarily initiate renegotiation proceedings, or should they let matters stand?

In some circles the idea is being passed around that it is better to stand pat, and hope that nothing will happen. Not only is this an unpatriotic attitude, but it is definitely against the best interests of any well conducted business. The fact is that by immediate voluntary renegotiation a contractor may put himself in a position to be allowed more profit than he will receive if he waits until the end of his fiscal year, and is called in for review. This possibility of extra profit is due to the basic principle of the War Department Price Adjustment Board that the efficient producer of war goods is entitled to better reward than the average, or mediocre, performer.

How it works—When a profit position is reviewed prior to the end of a fiscal period, the right is reserved to look at the final figures. If the realization is notably greater than the estimate, the matter may be reopened. However, if there is an increased profit which is due not to the mere action of mass production or some similar principle but to the skill, extra effort, ingenuity or inventiveness of the contractor, such increased profits will not necessarily be grounds for reopening the matter. Under such circumstances the contractor may retain the profit or a part of it as a reward for his extra contribution to the war effort. If the same contractor waited until the end of the fiscal period before having a review, he would not be so well off, because the whole period would be reviewed.

Another way in which the initiation of renegotiation can serve the interests of the contractor is through the avoidance of duplication of review. Ordinarily a procurement officer may approach a contractor at almost any time with a view to discussing possible downward revisions of price. When the contractor has a large number of contracts, placed through a group of procurement officers, this may lead to a considerable demand on his time and a certain amount of duplication in the presentation of cost figures. Once an overall renegotiation is commenced, individual procurement officers may not make any further examination of contracts, nor efforts to reduce prices during the fiscal period covered by the overall renegotiation. The method, therefore, makes for simplifying the operation, both for contractor and Government.

Renegotiation does not of necessity mean that there will be any change in prices or terms. It is a review which is undertaken for the purpose of checking the situation in regard to profits. In any event, the company doing war work in excess of $100,000 cannot be sure of its position profitwise until it has appeared for review. Until that matter is settled, the possibility of downward price revision must be carried as a contingent liability on the company's books. Hence it is a matter of good business prudence to get such figures cleared, and particularly in the case of publicly owned corporations whose balance sheets are open to all.

Negotiators are experienced men—It is obvious that renegotiation of profits is a matter which calls for sound, mature judgment, for a knowledge of corporation finance, and an understanding of the problems of management. Wrongly administered, it could become a punitive measure which missed entirely the aim of those who enacted it. Fully aware of this, the War Department has staffed its Price Adjustment Board with negotiators who have had long experience with important business enterprises.

Rewards for good performance—Renegotiation has a further advantage because it considers many factors relevant to fair profits which are totally disregarded by taxation formulae. For example, it is the policy in renegotiating war contracts to consider the record of the contractor in the use of raw materials and manpower, and as an expeditious producer of goods. If his performance is superior, it is the Board's view that he is entitled to a higher profit than another producer making the same material, but at higher cost, with slower output, or less efficient in other ways. No taxation formula could function on this basis. Similarly, contractors who share their patent and other rights or who make themselves particularly useful to the job can count on making a larger profit than the run-of-mine, or below average, producer. Here again are conditions that could not be handled by any possible taxation formula.

HOW FAR DOES WMC GO?

Although some 85 industrial areas have been tentatively designated as "plentiful" labor areas, "areas in which all possible effort should be made to renew contracts, place new contracts, and locate new production facilities," WMC officials were vague in telling MODERN PLASTICS just how this would work out.

The War Manpower Commission was quick to deny that it had put out any "directive" on the subject, asserting one had been put out October 10 by the War Production Board, and that revisions since then had only been "interpretations." The areas were listed in Group IV of a revised classification issued by WMC for "guidance" of the War Production Board and Government procurement agencies in placing war contracts with consideration for manpower factors. Group IV is further defined as including "all areas in which available labor supply is not fully utilized on essential civilian or war production or in which a substantial surplus of war workers exist."

Insofar as award of new contracts, or renewal of old contracts to firms in the non-Group-IV areas (that is, the Revised Group I areas), the War Manpower Commission is adamant, even though some of these plants are tooled up to finish their present jobs and start on new ones. Thirty-one areas are listed in the Revised Group I, which consists of areas in which no renewal of contracts should be made, and no new contracts placed, if alternative facilities are available elsewhere. The group includes, to quote the WMC release, "All areas in which the current labor requirements cannot be met, except through the release of workers now employed in production for which facilities exist elsewhere," and, "all areas where labor requirements have been or are being met only through substantially necessary in-migration, or where large-scale special recruitment programs have been or are immediately necessary to draw upon reserves of women and other individuals not customarily in the labor market." The order, and its subsequent interpretations, is aimed at alleviating labor conditions in so-called "critical" areas, of course, and in so far as most Government purchasing agencies are concerned, they are paying some attention to it, in that they are not letting contracts to plants in the areas where WMC has certified there is no manpower available.

However, there is some friction as to the renewal of contracts to companies which are already tooled up, and in the case of

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ERIE Resistor's pioneering work in the injection molding field is, to a large degree, responsible for the rapidity with which custom injection molded plastics are replacing critical materials in almost every industry today. Most important among these replacements are those items used in the weapons of war.

The machine gun parts illustrated are but a few of the many plastic articles now used in the manufacture of war equipment. Speedy production, dimensional accuracy, durability and weight are factors of utmost importance when designing, engineering and manufacturing plastic products. As the pioneer custom injection molder in this country, Erie Resistor is well equipped in trained personnel and modern production facilities to meet the most exacting specifications of today's war time requirements.

If you are faced with a problem of replacing critical materials for war time applications, consult with our engineering department. They will gladly make recommendations without obligation.

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plastics molders, "molded up," to make the products. The WMC order (or interpretation) deprives these plants of contract renewals, if they are in a so-called "shortage" area, even though they may be in shape to go ahead with the job they've already been doing. The purchasing officer of the Army, Navy or other armed service may, though, override the WMC dictum and continue his contract with the contractor with the "know how," in spite of the Commission. He may have some trouble in making it stick, but he still has the prerogative. So far as can be found out, the WMC is not applying the measuring stick of logical production too firmly in determination of the plastics molders—or other fabricators—who receive Government contracts. Perhaps, when they get more personally acquainted with the business, they will.

There is an appeal possible—through the War Manpower Commission—and it's open to both the molder or fabricator, and to the purchasing agency.

ORDER M-154 RESTRICTS THERMOPLASTIC USE

Complete restriction of the use of thermoplastics in the manufacture of nonessentials is ordered by an Amendment to Order M-154 issued early in January. The order abolishes the "ladder of uses" as far as thermoplastic use is concerned.

THERMOPLASTIC MOLDERS READY TO COOPERATE

With few exceptions, members of the thermoplastics industry who met last month with the War Production Board Plastics Branch are ready to "go along" on leasing, sale or rental of machinery needed to produce war goods.

The critical situation facing the industry was discussed at the meeting and everyone present seemed to be in accord with the Government's plans for getting the proper equipment to those contractors who needed it. Members of the industry who attended the meeting, designated as the Thermoplastics Processors Industry Advisory Committee, were advised of the number of requests being received for extrusion and injection molding equipment for war jobs, and were told that, in a large number of cases, priorities for new machines cannot be recommended because there is available equipment not now engaged in war production. The committee members agreed with the Chemicals Division of WPB that although individual processors are heavily loaded with war work, a majority of the companies in the industry are still engaged largely in civilian production. Furthermore, it was said, some of their equipment is running only part time.

It was suggested that a possible means of directing available facilities to war production would be more rigid controls on plastic raw materials, including scrap. Another suggestion was a limited rental price for injection and extrusion machines which would make it possible to supply contract war orders through mandatory acceptance of preference rated orders. Still another was to have a clearing house, such as one of the WPB sections, advised of all available industry equipment.

While no action has been taken, all the suggestions are being given careful consideration and the one which appears to have the inside track is the proposal for limited rental rates on necessary equipment.

PLASTICIZERS SHORTAGE ACUTE

Most critical of the situations facing the plastics industry appears to be the shortage of plasticizers. While raw materials for cellulose acetate are in fairly good shape in so far as supply is concerned, it is emphasized here that the plasticizer position is impeding output of many plastics products, particularly goods for civilian use. At the same time, it is said that a great deal of experimentation has been going on on new plasticizers not requiring critical ingredients. Pyroxylin, basic material for cellulose nitrate plastics, becomes more and more difficult to obtain, which bodes ill for wider utilization of these plastics in civilian goods until the war is over.

CELLOPHANE RESTRICTIONS

Early in January, WPB issued Limitation Order L-20, which further restricted use of cellulose film. In issuing the order, the Chemicals Division of WPB said that the film is needed for Army gas capes and, further, that some of the constituents of the film are on the "critical" list, namely, glycerine, nitric acid and high alpha wood pulp.

BIG DEMAND FOR COAL TAR CHEMICALS

Consumption of coal tar chemicals still continues to increase, despite the Government's synthetic rubber program and other developmental programs. Benzol is still being stockpiled for use in synthetic rubber production, creosote is being used by utilities in normal quantities, and phenol shipments for Lend-Lease purposes are continuing. The supply of cresylic acid is likely to remain extremely tight for the duration, although there are some small lots being received from England.

METHANOL TO BE ALLOCATED

Demands of the armed services and Lend-Lease requirements led to the issuance, Jan. 7, of an amendment to Order M-31, placing methanol completely under allocation. WPB said, in issuing the amendment, that a shortage of around 10,000,000 gallons was expected in 1943, unless use for nonessential items is curtailed.

The increase in demand is due to its use in manufacture of methyl methacrylite resin for military aircraft; also, it is due to the requirements for formaldehyde to produce hexamethylene tetramine, an ingredient in explosives manufacture used both in the U. S. and Great Britain.

PLASTIC PARTS AND SUBASSEMBLIES

A new order, No. 229, was issued by OPA Jan. 20 which affects maximum prices of a wide range of plastic parts and subassemblies produced by molders and fabricators. The new order does not affect electrical, radio or communications parts, or other parts now covered under Regulation 136 (about 60 percent of all products), machines, parts and machinery services. Nor does it affect completed consumer goods, which are already subject to Regulation 188 (about 20 percent of all products).

However, parts and subassemblies of consumer goods are covered, when sold as such—for example, the plastic base of a lamp, sold to a lamp-maker for assembly.

The new order comes under the General Maximum Price Regulation, changing it to make it more nearly applicable to these parts, since it has been more or less inoperative in fixing their prices. Broadly, here are some of its provisions:

1. It eliminates the provision in "Gen. Max." which makes it necessary for manufacturers to get special authority to determine the maximum price for new articles—that is, articles not made in March of last year, the "base date" of the main order.

2. Molders and fabricators of such new products are authorized to use the pricing methods and rates which were in use on other articles in March 1942 in determining the prices for the articles which have been developed and made since that date. This includes labor rates (per piece), overhead, margins and other cost factors, which may be applied under the new order on the same basis as they were applied to pricing of items being made on March 31, 1942.

3. In figuring the cost of materials going into the new products, they must be computed at the price actually paid, as long as they do not exceed the maximum prices established by "Gen. Max." or any other maximum price orders. This applies to inserts, molding materials and other materials. Under this provision, the supplier of the materials and the purchaser are equally liable if the price paid exceeds the maximum price established for such material. The OPA suggests that the purchaser should get a statement on his invoice for such materials that the price charged does not exceed the maximum price established for such material. (*Please turn to next page*)

ANNOUNCING

the acceptance of entries for

THE SECOND ANNUAL JOHN WESLEY HYATT AWARD

for the advancement of plastics

The John Wesley Hyatt Award Committee will accept entries in its second Annual Competition.

Entry blanks may be secured from the Secretary, William T. Cruse, 295 Madison Avenue.

Pre-conditions of entry are that an individual, whether he be a molder, toolmaker, executive or technician, or in any other category, has made a significant contribution to the advancement of plastics which has had a measurable effect during the calendar year 1942. The contribution might have been made earlier, and the effect felt only in 1942. Thus, many who entered the 1941 Competition might still be considered eligible.

There are no fees for entry. There are no limitations on entries. Anyone may enter, or be entered.

Prize consists of the Manship Plastics Medal *and* $1,000.00 *in cash.*

Entry Blanks from

JOHN WESLEY HYATT AWARD COMMITTEE

Attention WILLIAM T. CRUSE, *Secretary*

295 Madison Avenue New York City

4. In cases where no pricing method in use on March 31, 1942, is applicable to new products (this is a possibility in the case of conversions of plants from manufacture of other products to plastic products) the molder or fabricator is required to file a proposed method of pricing with the Washington office of OPA, naming all cost methods, or formulae, and must indicate that all his pricing is being done according to such a formula or formulae.

5. Recomputation of his maximum price at any time is afforded the molder or fabricator, based on his manufacturing experience. If, in the course of recomputation, following a particular job, he finds that he lost money on it, he may increase the cost, and price, on the next run, establishing a new formula, but must report this change to the OPA, giving his reasons. The order provides a blank in which he can specify these reasons.

If his recomputation should result in a lower cost, or price, then the lower price prevails, although the manufacturer or fabricator need not report it. However, it is made plain that if the price comes out to be higher, he must report it to OPA (if he charges the higher price). In some cases, it is expected that competitive conditions will influence a manufacturer to keep his price low in the belief that on the next "run" he can pare costs and still make some money. He can always charge below the maximum price, but not above, without special authority.

The order is being sent out to the entire industry, but in case some manufacturers do not get it, it may be obtained from OPA.

WPB TO STUDY DISTRIBUTION

A study of the progress which has been made to date in simplification and standardization in the field of distribution will be made by the Office of Civilian Supply of the War Production Board, it was announced by Joseph L. Weiner, director. In charge of the study will be Irwin D. Wolff, consultant to Mr. Weiner, who has been engaged for several weeks in a similar study of the progress of simplification and standardization of civilian goods. Explaining the reason for the second study, Mr. Weiner, said that progressive restrictions upon raw material for the manufacture of civilian products, and the heavy drains of war production upon manpower are creating an increasingly serious problem for the approximately 2,000,000 retailers and wholesalers in this country. Both studies are in line with carrying out a request of James F. Byrnes, Director of Economic Stabilization, that WPB undertake a vigorous program of simplification and standardization.

ALLOCATION OF NITROCELLULOSE

Nitrocellulose allocations in February probably will be somewhat freer than this month which was itself considerably freer than some previous months, it was indicated today at WPB, following Washington meetings last week of 2 industry advisory committees in the field. Several sources of nitrocellulose not previously counted upon have been discovered, it was said, resulting in the forecast of higher allocations. The allocation pattern was discussed at some length by the members of the Pyroxylin and Vinyl Resin Coated Paper and Fabric Industry Advisory Committee. At the same time, this committee as well as the Oleoresin and Tower Oil Coating Advisory Committee weret old by Government representatives that all ethyl cellulose produced is going direct to Army and Navy uses, with none available for civilian use. A representative of the Quartermaster Corps told the Committees of the results of experiments in the use of Koroseal, VYNW Vinylite resin and VYNS Vinylite resin as coating for army raincoats. Polyvinyl butyral previously used for this purpose has been curtailed, with the exception of the thermosetting type. Members were reminded that the supply of castor oil, formerly used in pyroxylin coatings, is short, and that in all probability none will be granted in the future for shoe plasticizing, pyroxylin finishes, or coatings for shoes for civilian uses. While it has been allowed for military purposes it is possible specifications of some military articles may be changed to permit substitution.

Application for Raw Materials—Manufacturers of synthetic resins must apply for raw materials required in the production of phenolic and alkyd resins regardless of the fact that those resins are under allocation, according to the Chemicals Division of the War Production Board. When a manufacturer of synthetic resins applies to WPB for any one of the raw materials required for a phthalic alkyd resin, such as castor oil or phthalic anhydride, he should fill out Form PD-600 in accordance with the manner specified. In the case of alkyd resins this would be Order M-139. If raw materials for phenolic resins are requested, however, the applicant should list either Order M-246 or Order M-254, as the case may be.

• • •

Styrene Sales—The issuance of WPB General Preference Orders M-178, M-170 and M-153, all as amended, provide that manufacturers of butadiene, styrene and acrylonitrile may supply small amounts of these materials to customers over and above their quota allotments. The order provides that a manufacturer may deliver each month on small orders one quarter of one percent of the amount of material he is specifically authorized to deliver under allocation restrictions. Small orders are interpreted as 125 lb. or less for butadiene and 50 lb. or less for styrene and acrylonitrile.

• • •

Isopropyl—WPB has announced that standard chemical forms PD-600 and PD-601 will be used henceforth in allocation of isopropyl alcohol under the amended General Preference Order M-168, just issued by the Director General for Operations.

• • •

Adhesive Tape—As a means of conserving vitally needed crude rubber, the Conservation Division of WPB endorsed and urged the use of non-rubber pressure sensitive (adhesive) tape for masking plastic airplane glass to prevent scratches or damage during shipment. Crude rubber pressure sensitive tape, which consumes thousands of pounds of crude rubber monthly, has been used for this purpose. Other military uses for this non-rubber pressure sensitive tape are: to guard against the damaging effects of moisture, all apertures of tanks, planes and small arms shipped overseas are sealed with the tape in transit; to prevent loss pending assembly, unassembled parts of machines are grouped and held together with the tape. This tape also is used on a large scale for masking surfaces to be painted, replacing the high grade reclaim rubber tape previously used.

• • •

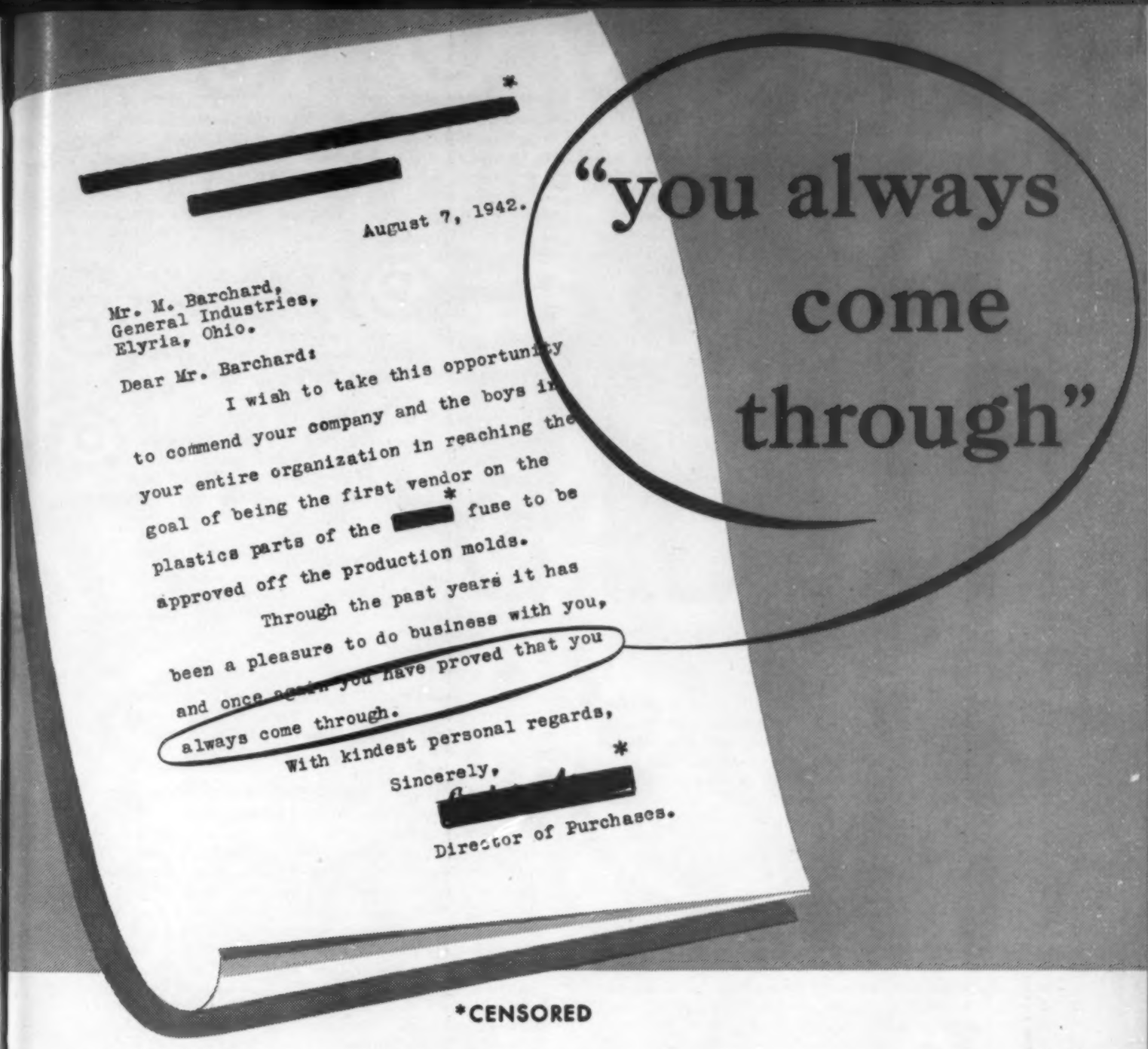
Acrylic and Phenolic Resins—The War Production Board has announced the January allocation of acrylic resins, ethyl cellulose and phenolic resin protective coatings. Acrylic resins for dentures were granted in part. Ethyl cellulose was allocated in full except where end use was not warranted and where substitutes could be used—for food, transportation, communication and utilities, photography and x-ray, industrial uses, and printing and publishing, but denied for civilian clothing, civilian furniture and civilian plastics. Phenolic resin protective coatings were granted in full for medical, pharmaceutical, food, health supplies and printing and publishing (to the extent of conforming with M-53) but denied for first aid, air raid defense, fire extinguishers, utilities and transportation, except use in armatures and coils.

• • •

Distribution of Chemicals—The WPB has released the January list of allocation of chemicals under orders of the Chemicals Division. Copies of the listing may be procured from the WPB.

• • •

Electrical Insulating Varnish—Representatives of the industry were advised by the Protective Coatings Section, Chemicals Division, of the desirability of having various formulas made up. Such formulas, thoroughly evaluated, would make use of a variety of different raw materials which in turn might involve a study of linseed oil in combination with phenol resins as wall as oiticica and castor oil formulas. Increased use of electrical insulated coatings was suggested for the following: surface coatings for cloth, varnishes for impregnation of coils and wound apparatus, enameled wire and electrical insulating finishing varnish.



*CENSORED

WE PRIZE MORE than any award the commendation of our customers for work well done and delivered "On Time." The plastics parts referred to in this letter are among the most difficult ever turned out. Production was undertaken by other molders in advance of General Industries, yet General Industries was the first to deliver. It is this record consistently maintained for "coming through" with quality, accuracy and "On Time" that has brought General Industries to the forefront among America's plastics molders.

THE GENERAL INDUSTRIES COMPANY
Molded Plastics Division . . . Elyria, Ohio

GENERAL INDUSTRIES

★ ★ MOLDED PLASTICS ★ ★

Plastics rate an "E"

★ THE FIRST COVETED ARMY-NAVY "E" TO BE given to a firm which specializes exclusively in injection molding was awarded on January 8th to the Franklin Plastics Division, Robinson Industries, Inc., at Franklin, Penna. In colorful ceremonies (below), the pennant presented by Brig. Gen. Ray L. Avery was accepted by Wm. S. Perry, president of Franklin Plastics Division. Awards of the "E" pins to employees were made by Commander Ralph G. Walling, naval officer in charge of the Erie (Pennsylvania) District, to Rose Pangallo and Floyd S. Kerschner. The ceremony was held at the Franklin High

School auditorium before an assemblage of nearly 1000 citizens. Earlier activities in the day's program included a luncheon at the Lincoln Club for the honor guests and a tour of the plant.

★ ON JANUARY 26TH, EMPLOYEES AND MANAGEment of the Mack Molding Company, Wayne, N. J., received the Army-Navy "E" award for excellence in war production at ceremonies attended by more than 300 persons and held in the Wayne Junior High School. On behalf of the employees, Charles A. Dulanto, president of the Plastic Workers Union at Mack Molding, accepted the award of "E" pins from Lt. J. Douglas Gessford, U.S.N.R., and for the management Kenneth W. Macksey, president of the company, accepted the "E" burgee from Lt. Col. Chester Meller, U.S.A.

★ ON JANUARY 29TH, THE BRISTOL, PA., PLANT OF Rohm & Haas Co., Philadelphia, Pa., whose highly transparent acrylic sheets are used for turrets, cockpit-covers and noses of U. S. warplanes, received the joint Army-Navy "E" pennant for its excellent production record of their Plexiglas airplane enclosures. The presentation rally, at which Dr. Thomas S. Gates, President of the University of Pennsylvania, acted as master of ceremonies, included a presentation of the "E" pennant by Brig. Gen. F. O. Carroll of Wright Field, and distribution of the "E" pins to Rohm & Haas workers by Lt. Comm. O. R. Sutherland of the Philadelphia Navy Yard.

★ EMPLOYEES OF THE FORMICA INSULATION CO., Cincinnati, Ohio, have been congratulated on their production attainment of important aircraft units for the Glenn L. Martin Co. by Rear Admiral John S. McCain, Chief of the Navy Bureau of Aeronautics, via a letter from Glenn L. Martin, head of the company. Following that came announcement of the Army-Navy "E" award, first in the Cincinnati area for exclusive production for the Army Air Forces.

★ THE DOW CHEMICAL CO., MIDLAND, MICH., IS the recipient of the Army-Navy "E" award for production excellence presented by Major Gen. William N. Porter, Chief of Chemical Warfare Service. Gen. Porter paid special tribute to the company for their consistency of production as well as for their increase, which in some instances has been almost double.

★ THE THIRD ARMY-NAVY "E" TO GO TO A NYLON plant has been awarded to the E. I. du Pont de Nemours & Co.'s Nylon Research Laboratory and pilot plant at Wilmington, Del., in recognition of the importance of scientific investigation for the military program. Nylon is now 100 percent in the war program, except for a small allocation for toothbrushes.

★ NEW LAURELS HAVE BEEN HEAPED UPON THE Monsanto Chemical Co. with the award of a triple Army-Navy "E" to their St. Louis and Monsanto plants and to the St. Louis Chemical Warfare Service plant operated by them. The number of Monsanto awards for production now stands at fifteen.

★ THE BOUND BROOK PLANT OF BAKELITE CORP. has recently been awarded the Army-Navy "E" for six months of continued high standards of production. The presentation was made by Lt. J. Douglas Gessford, U.S.N.R., to R. B. Lowe, works manager.

★ ON WEDNESDAY, JANUARY 20TH, WORKERS AND management of the Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J., received the Army-Navy "E" award for excellence in war production from Gen. Alden H. Waitt, Chemical Warfare Service, United States Army, and insignia pins for every employee from Commander Herman J. McCarthy, U. S. Navy, in a colorful ceremony which was broadcast through the metropolitan area over radio station WJZ. The presentation, which was held in one of the plant buildings, featured fighting speeches by Gen. Waitt and Commander McCarthy and a gracious address of acceptance by F. M. Fargo, Jr., General Manager, and Frank J. Pucci, President of the Chemical Workers Union Local. The ceremonies were presided over by E. J. Dempsey, Works Manager at Calco. Paul Robeson, famous Negro baritone, opened the ceremonies with the song, "America," and concluded them with his rendition of the national anthem in which the audience of more than 4000 joined.

Since the inception of MODERN PLASTICS magazine, the editors have tried constantly to improve both its content and its appearance. We had the idea that readers appreciated beauty in a magazine as well as articles chock-full of information and facts. Our steady growth has proved that this idea was sound.

It is not reasonable to expect, however, that any field of civilian activity can remain untouched by the war, and the time has now come when newspapers and magazines must make some necessary changes in format. To release manpower, transportation, machinery, electrical energy and paper for more important uses, the Government has decided that all magazines must cut their paper consumption to 90 percent of the amount consumed in 1942, and that the copper and zinc used in cuts must be reduced by approximately one-half.

Inevitably this means a cut in the amount of space we shall have available for telling the story of what plastics are doing. We think that story is so important that it should *not* be cut short. So we're going to tell it just as fully as we have in the past.

This means that we shall have to use somewhat smaller type, narrower margins and fewer illustrations. Our primary function, as we see it, is to inform you, the reader, as fully as possible, and consequently the beauty which you have grown to expect will suffer some.

Naturally, we're going to make MODERN PLASTICS as attractive as we can within these limitations. But you may notice a difference. If so, we know you'll understand that we don't like it any better than you do. On the other hand, we feel that this is a very small sacrifice to make if it helps speed victory.—THE EDITORS

SOMETHING TO SHOUT ABOUT

Megaphones for lusty tars and Marines to shout messages through formerly consumed over 50,000 pounds of precious brass for the mouthpieces, handles and rims. Megaphones are certainly essential, but brass is needed so desperately in other applications, the Navy called on plastics to replace the metal.

The final job is a great improvement over the original material used.

Cruver engineered this conversion to comparatively non-strategic cellulose acetate plastic. The material is injection molded in quick cycles, saving not only the metal but precious man and machine hours previously spent in forming the brass parts.

This is another of Cruver's creative conversions to plastics for war. Others will be shown in subsequent issues.

Cruver plastic mouthpieces, handles and rims on megaphones save over 50,000 lbs. of brass for the armed forces.

Cruver

MANUFACTURING COMPANY

NEW YORK
2 WEST 46TH STREET

CHICAGO
2456 W. JACKSON BLVD.

SPECIALISTS IN CONVERTING PLASTICS TO WAR

Publications

Write directly to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationary. Other books will be sent postpaid at the publishers' advertised prices

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National Paint Dictionary

by Jeffrey R. Stewart

Stewart Research Laboratory, Publishers, 1340 New York Ave., N. W., Washington, D. C.

Price $7.50 **224 pages, 200 illustrations and charts**

The second edition of this dictionary, revised and expanded, combines a handy reference volume for laboratory, office, library and home. Concise definitions of terms and trade names of raw materials used in the paint and allied industries are supplemented by comprehensive pertinent data. Important testing devices and apparatus used in the laboratory are described and there are illustrations, charts and tables. The dictionary is printed in clear, easily read type.

Industrial Chemistry, 4th Edition

by E. R. Riegel

Reinhold Publishing Corp., 330 W. 42nd St., New York, 1942

Price $5.50 **861 pages, 294 illustrations**

The heterogeneous processes and products which comprise the contribution and responsibility of the chemical engineering profession to the wellbeing of the nation in time of peace and to its safety in time of war are surveyed in this comprehensive textbook. It is significant of present trends that the chapters relating to the synthetic organic field have been largely rewritten for this edition. These revisions deal with recent advances in synthetic plastics, synthetic textile fibers, rubber, petroleum and its products, and cellulose from wood. G.M.K

14,000 Gear Ratios

by Ray M. Page

The Industrial Press, 148 Lafayette St., New York, 1942

Price $5.00 **404 pages**

Data useful in designing various types of transmissions, including spur, bevel, helical and worm gearing, are presented in tables. Problems relating to practical gear combinations to obtain precise timing or speed relationships between driving and driven shafts can be solved readily by reference to these figures which are listed in both common fractional and decimal forms. About 14,000 two-gear combinations and millions of possible four-gear combinations are included.

Strategic Materials in Hemisphere Defense

by M. S. Hessel, Walter Murphy and F. A. Hessel

Published by Hastings House, 67 W. 44th St., New York

Price $2.50 **235 pages**

The complex problem of the supply of strategic and critical materials becomes increasingly complex with every succeeding headline, and each passing day. The authors of this volume have attempted to translate the complexities of wartime procurement problems into terms that the man on the street would have no difficulty comprehending. The discussion centers about the fourteen strategic and fifteen critical materials on the Army's list, their chief source of supply, their potential sources, their uses and their relation to our own needs. Pictograph instead of figure diagrams have been used in the interests of clarity and visual appeal.

The picture that evolves is not a cheerful one. The facts grimly bear out the oft repeated warning that our enormous natural resources are not sufficient to win a decisive victory unless they can be substantially supplemented from other sources.

★ THE ORGANIZATION AND TRAINING OF INDUSTRIAL Fire Brigades," by Captain John C. Klink of the Memphis Fire Department, offers a basic course of instruction for private brigades in the methods and practices of the public fire department. Written in non-technical language, 128 pages, with over 150 illustrations, this book has been endorsed by foremost authorities in the fire-fighting field. Published by S. C. Toof & Co., 195 Madison Ave., Memphis, Tenn., the $1 book is offered at a special discount to companies organizing brigades among their own employees.

★ PORTER-CABLE MACHINE CO., SYRACUSE, N. Y., has issued a 24-page booklet, "Wet-Dry Belt Surfacing," describing the advantages of belt surfacing, particularly for firms producing metal or plastics parts of small size. Some benefits to be gained by using this surfacing method: elimination of duplicate handling, dust prevention, heat control, use of semi-skilled hands, and production of accurate, straight-grain surfaces.

★ RESINOUS PRODUCTS AND CHEMICAL CO., PHILADelphia, Penna., recently issued the second in a series of technical bulletins of interest to the plywood industry and to woodworkers in general. "Uformite CB-551, Cold Bonding Studies" deals with the use of cold-setting resin adhesives for aircraft, glider and marine assembly work. Feeling that many aircraft manufacturers have had limited experience with cold-setting resins, the company has gone into detail on the techniques of their use.

★ A NEW CATALOG OF THEIR SEMI-AUTOMATIC and preforming presses has been issued by F. J. Stokes Machine Co., Philadelphia, Penna. The 16 pages are fully illustrated, and carry descriptions of the numerous improvements which have been made on these presses from time to time.

★ HALOWAX PRODUCTS DIV., Union Carbide & Carbon Corp., New York City, has just released a new 12-page booklet, "Vinylite Plastics for Wire and Cable Insulation," which discusses practical advantages to be gained by using this new synthetic insulation for most of the purposes previously served by rubber. Changes in wire design and application made possible by use of the resin compound are also reviewed. Tables give physical and electrical properties and typical applications.

★ "RUBBER GUIDE BOOK FOR AMERICAN WAR INdustries" is the title of a new 30-page booklet from the B. F. Goodrich Rubber Co., Akron, Ohio, designed to present maximum information in condensed form. Listing the properties and application of products using natural, synthetic or reclaimed rubber, the fully illustrated manual is divided into 11 sections.

★ *GLUE PLASTICS AND YOU* IS THE TITLE OF A speech recently delivered by I. F. Laucks, president of I. F. Laucks, Inc., Seattle, Wash., and reprinted in booklet form for distribution. The structure of wood, and the fundamentals of gluing and plastics are briefly considered by the author in relation to the development of plywood aircraft.

★ A USEFUL LITTLE BOOKLET CALLED "CHEMICALS from Coal" has just been issued by Koppers Co., Tar & Chemical Division, Pittsburgh, Penna. The booklet consists of a series of data sheets which present the physical and chemical properties of those chemical compounds available from the Koppers Co., which are derived from coal tar.

★ AMERICAN CHEMICAL LABORATORIES MAY NOW obtain a complete line of analytical filter papers for both qualitative and quantitative analyses, produced with 100 percent American raw materials, labor and capital, according to Carl Schleicher & Schuell Co., New York City, manufacturers of S & S American filter papers. A 12-page bulletin, No. 65 describes the firm's available grades.

The thought of spring is in men's minds

Up here in Western New York there is still snow on the ground . . . but we've had our promises of the spring to come in our midwinter thaw and in the hours we've waited for the groundhog to cast his shadow. Even in the coldest weather there is consolation in the thoughts those things arouse.

Right now our whole country is in the winter of a hard war, but on the battle lines and on the busy production fronts, men are dreaming and planning for the Spring of Peace that will follow the day of Victory.

Here at home, in our own business of plastic molding, we can see the signs. We are "up to our ears" in war production, but through all of the rush and the intense twenty-four hour a day concentration on the job we are doing, runs a hint of the better things to come.

We are learning new ways of doing things, of new uses for plastics. To our more than sixty years of experience we are adding a vast new store of knowledge that is going to help you use more plastic parts more effectively in the brighter future America is building with its fighting courage, its machines, and with the dollars all of us are putting into War Bonds.

MOLDED PLASTICS DIVISION

AUBURN BUTTON WORKS

Molders of All Types of Plastic Materials by Compression, Transfer Injection and Extrusion Methods

ESTABLISHED 1876 AUBURN, N. Y.

In the plastics picture

JAMES L. RODGERS, JR.

WILLIAM THEILE

★ THE PLASTICS MATERIALS MANUFACTURERS' Association at its annual meeting on January 14 elected officers for the coming year. To replace Arnold E. Pitcher, who has headed the Association since its beginning, James L. Rodgers, Jr., president of the Plaskon Co., Inc., was chosen. New vice-president will be William Theile, president of Catalin Corp. John E. Walker will continue to act as secretary-treasurer.

President Rodgers has announced the appointment of the following committees:

Committee on War Effort
- L. M. Rossi, Bakelite Corp., chairman
- William Theile, Catalin Corp.
- W. S. Landes, Celanese Corp. of America
- A. E. Pitcher, E. I. du Pont de Nemours & Co., Inc.

Technical Committee
- C. J. Romieux, American Cyanamid Co., chairman
- Clinton Blount, Bakelite Corp.
- Spencer Palmer, Tennessee Eastman Corp.

This Technical Committee will appoint a sub-committee consisting of technical men representing all types of plastics manufactured by the Association's members.

Membership Committee
- Harry M. Dent, Durez Plastics & Chemicals, Inc., chairman
- George Simon, American Plastics Corp.
- P. C. Reilly, Jr., Reilly Tar & Chemical Co.

The Defense and Government Relations Committee reported considerable progress in revising the Technical Data Book which they plan to make available to Government agencies, to various educational institutions, and to the industry in general. This compendium of information on properties of plastic materials, proper methods of testing them, and improved specifications for plastics in war matériel, is designed to assist Government and the industry in making the fullest use of plastics for war purposes.

Two groups were named to work on plastics requirements for radio for the military services. These are Drafting Group No. 7, composed of H. K. Nason of Monsanto Chemical Co., representing PMMA; and W. G. Goggin of Dow Chemical Co., and Charles Stock, American Cyanamid Co., representing industry. The other group, known as Drafting Group No. 8, includes John E. Adams of the Bakelite Corp., representing PMMA; and L. Santag, of Durez Plastics and Chemicals, Inc., and John Teeple, Celanese Corp. of America, company representatives.

PMMA's plans for the year ahead have been briefed by President Rodgers as follows:

"The program and policy of the Association will continue unchanged. It goes without saying that our major effort will be directed toward assisting the armed services of the country in the solution of problems involving plastic materials.

"Our Committee on War Effort meets regularly each month in Washington and has in the past been able to expedite matters of interest to the Army, Navy and War Production Board.

"The second edition of our Technical Data Book will shortly be published and will be given wide circulation. No effort is being made to copyright this material, as it is felt that we would prefer to have it used in the broadest possible manner.

"We plan to continue the closest possible cooperation with the Society of the Plastics Industry, the American Society for Testing Materials, and any other organizations with which we have common problems."

★ TUESDAY, JANUARY 26, WAS THE DATE OF THE second meeting of a group of New York plastics sales engineers and sales representatives. This second meeting was held at the Old Timer and was attended by a fairly large and representative group. After an excellent repast, the group was favored with two down-to-earth discussions on materials.

William H. MacHale, American Cyanamid Co., spoke about the origins and development of the various melamine compounds and described many of the uses to which they have been put. Carl Whitlock, Monsanto Chemical Co., discussed high impact materials with special reference made to the advisibility of preforming these materials before molding. Mr. Whitlock also described a new piece of molding equipment which is capable of injecting over three pounds of either thermoplastic or thermosetting materials. He showed the group two samples of a three-pound test part which were successfully molded by this machine. [*Editorial Note:* MODERN PLASTICS *is investigating this machine and a complete report will be forthcoming in an early issue.*]

Following these two discussions, Chris Groos, Boonton Molding Co., acting as temporary chairman, appointed a committee to study the advisability of organizing this group and setting some means of collecting dues to cover the necessary administration expenses. This committee was made up of the following:

C. W. Marsellus, Universal Plastics Corp.
Nicholas Klein, Injection Molding Corp.
T. A. Ryan, Hemco Plastics Div., Bryant Electric Co.
D. Gray Maxwell, Waterbury Button Co.
N. G. Levien, Ivorycraft Co.
Kenneth C. Ogden, Niagara Insul-Bake Specialties Co.

THEODORE MARVIN

★ THEODORE MARVIN, ADVERTISING MANAGER OF Hercules Powder Co., has been selected industrial advertising's "Man of the Year" for 1942, by *Industrial Marketing* magazine. The award was based on the year-round high standard of Hercules advertising directed to the chemical industries. Mr. Marvin has headed the Hercules advertising department since 1931.

★ CELLULOID, THE FIRST PLASTICS TRADEMARK, born of shortages and a five-year development period, has celebrated its 70th anniversary. (*Please turn to page 110*)

"THIS PLASTIC AGE"—NEW SOUND AND COLOR FILM

American educators, industrial leaders, military and Government officials and the leaders of the plastics industry acclaimed the latest MODERN PLASTICS film, "This Plastic Age," at its premier showings. Hailed as an outstanding dramatic and informative presentation, a thrilling story of the "magic" materials which are now so much in the public eye, this latest production, the third in a series of unbiased, propaganda-free, documentary films about plastics, was presented to over 250 members of the plastics industry in New York on Jan. 29, at a showing sponsored by MODERN PLASTICS magazine. At a special premiere showing, held in Washington, Feb. 1 and attended by over 300 guests, Army, Navy and Government men expressed great interest in this lucid, pictorial translation of scientific facts about plastics into clear pictures of the part plastics is playing in the war, the analysis of what plastics are, what they can do and have done. Following the Chicago premiere on Feb. 5, where the film was exhibited to a select gathering of over 250 representatives of midwest plastics manufacturers, the film started on tour to leading universities, schools and colleges, business organizations, engineering societies, fraternities, sales meetings and civic groups throughout the country.

"This Plastic Age" is a three-reel, 16-mm. sound film produced entirely in full color which shows the thrilling beauty of plastics products, from the test tube on through the processing plant, the fabricating or molding plant, to the final finished product. The film, in brief, tells how plastics are made and pictures molding and extruding plants. In simple non-technical language, "This Plastic Age" explains how plastics differ in production from other materials, what their peculiar properties are and how they can serve the world of today and tomorrow. In a thrilling sequence, showing American plastics at war, plastics on the battlefield, on the decks of warships, in guns, airplanes and tanks are pictured actually in action. Milton Cross, well-known radio announcer, is the commentator and his spell-binding script is packed full of interesting information, and important news about this newest of modern materials—plastics!

Due to the shortage of cinema film, the number of prints of "This Plastic Age" has been greatly restricted. Only responsible organizations or institutions will be granted permission to use this film—which is available without charge—and bookings will have to be made far in advance. Address, Publicity Director, MODERN PLASTICS, 122 East 42nd St., New York City.

★ BEGINNING FEB. 8, A COURSE IN PLASTICS WILL be included in the curriculum of the Ford Airplane School at the Willow Run bomber plant, Dearborn, Mich. A general introduction to the subject will be given in the first 10-week term, followed by 7 terms of 10 weeks each, covering physical properties, physical tests and the working of the various types of plastics. At the conclusion of the full course, the school expects to institute courses in elementary organic chemistry and the chemistry of the various types of plastics.

★ ALLAN W. FRITZSCHE IS NOW SERVING AS THE newly elected president of The General Industries Company, Elyria, Ohio. Morris Barchard, O. W. Marsh, H. E. Moon and W. A. Schmittgen have been made vice-presidents.

Sorry!

★ THE RAYBESTOS DIVISION OF RAYBESTOS-MANhattan, Inc., whose resin-impregnated clutch facings and brake linings were reviewed in October, 1942, page 63, has asked us to inform inquirers that they manufacture a conventional fan-belt, but not one made of a plastic material.

★ THERE WAS AN ERROR IN THE LISTING OF TRADE names in the 1943 PLASTICS CATALOG. Textolite, a phenolic molding and laminating material, is made by the Plastics Division, General Electric Co., Pittsfield, Mass.

★ ROBERT C. BEGGS, FORMERLY IN ADVERTISING capacities with Republic Steel Corp., Wm. B. Remington Agency, and *National Petroleum News*, has reopened the Cleveland office of MODERN PLASTICS and PLASTICS CATALOG to serve readers, and those interested in plastics in that territory. Offices will be located at 1012 N.B.C. Building, Cleveland, Ohio.

★ PLASTICS INSTITUTE HAS OPENED THE FOLLOWing new forum classes: Bridgeport, Conn. No. 2 Forum opened in Bridgeport on Tuesday evening, Dec. 1. Conductor, Henry Cohen, plastics development engineer, Metropolitan Body Co.

Pittsburgh, Penna. No. 2 Forum opened in Pittsburgh on Tuesday evening, December 1. Conductor, Dr. G. S. Schaffel, chemist, Plastics Div., Westinghouse Electric & Mfg. Co.

Philadelphia, Penna. No. 3 Forum opened in Philadelphia on Wednesday evening, Dec. 2. Conductor, Arthur P. Dowling, plastics chemist, formerly with Durez Plastics & Chemicals.

New York, N. Y. No. 1 Forum opened on evening of Dec. 22. Conductor, Fred Duggan of Bakelite Corp. No. 2 Forum, which meets on Mondays and Thursdays, opened on Jan. 18 and is conducted by J. Gordon Lippincott.

★ CHARLES F. ELMES ENGINEERING WORKS IS NOW a part of American Steel Foundries, Chicago, Ill. The Elmes organization will continue to operate as a separate unit at its present address, Morgan and Fulton Sts., Chicago. Charles F. Elmes remains as general manager of the organization. Improvements in manufacturing facilities are being planned.

★ GUS N. ARNESON, FOR THE PAST 6 YEARS CHIEF of the Douglas Fir Plywood Association's research program, has been selected as the principal technologist for the expanding program of the U. S. Forest Products Laboratory. A specialist on wood veneers and glue, Mr. Arneson will organize additional studies on wood utilization to cope with the problems of the armed services.

★ FLORENCE T. HELMER, MANAGER OF THE ADVERtising division of Sylvania Industrial Corp., New York City, died suddenly at her home in that city on Christmas Day. Known for her work in the improvement of methods for color printing on cellophane, Miss Helmer was one of the pioneers in the development of the material.

J. P. TRICKEY

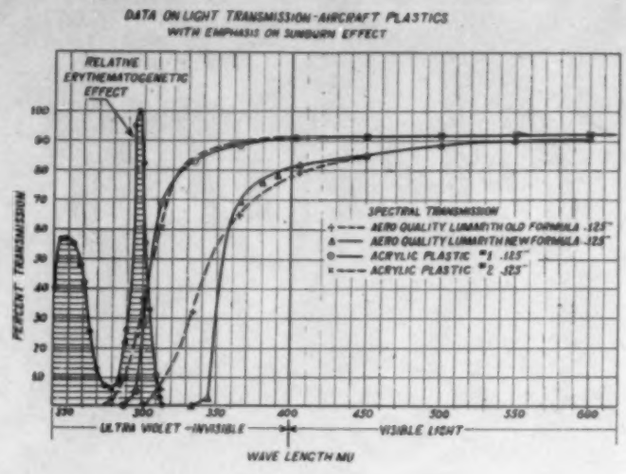
★ DR. JOHN P. TRICKEY, ASSISTANT TECHNICAL Director of the Plastics Industries Technical Institute, died in Los Angeles on January 17. Dr. Trickey has been identified with the plastics industry for some 25 years, in the course of which time he did significant work on the development of furfural in its application to plastics. With the Plastics Institute since 1941, Dr. Trickey was recently stationed in New York where he had established and headed a branch school of the Institute.

Protecting aviators from sunburn

THE problem of sunburn has caused some concern to medical officers of both Army and Navy Air Forces. Airmen exposed to sunlight behind acrylic enclosures for long periods are subject to severe sunburn. This is said to have resulted in loss of flying time of several days—or for longer periods if infection by contact with soiled gloves or other clothing sets in. While all exposed areas of skin are vulnerable, burns affect particularly forehead and eyelids, with consequent danger to eyesight. Other effects of intense ultraviolet rays are eye strain and fatigue. Sunburn is more likely to occur at high altitudes because there the intensity of the ultraviolet radiation which causes it is considerably greater than at the earth's surface. Much of today's flying is above a considerable part of the air blanket which protects the earth from this radiation. Then, too, the air at these heights is free from dust particles and water droplets which screen out many of the ultraviolet rays.

The accompanying chart prepared by Celanese Celluloid Corp. shows the relative erythematogenetic (sunburn) effect of the radiation of different wave lengths in the ultraviolet range.[1] It also shows the percentage of light transmitted in the visible and ultraviolet ranges by several plastic airplane glazing materials.[2] It will be noted that the two acrylic samples transmit considerable amounts of the sunburn-producing rays, the old Aero Quality Lumarith transmits much less, and Aero Quality Lumarith of the latest formula none at all. High-altitude exposure for long periods may produce effects not detectable in short-time, low-intensity laboratory tests. However, the curves show that the danger of sunburn can be greatly reduced by the use of the new type cellulose acetate sheet. Though some reddening of the skin is possible, painful or harmful sunburn will be greatly minimized behind windows of this special formula.

It should be understood that the foregoing statements apply only to the special formulations for aircraft. Other cellulose acetate formulae, notably those used for agriculture and animal husbandry where ultraviolet transmission is important, pass as much as 80 percent of the health-giving rays.



EDITOR'S NOTE: *Manufacturers of acrylic and methyl methacrylate sheet are now working on methods of filtering out the ultraviolet rays. One company reports that it is adding dyes to the monomer prior to casting the sheet in order to reduce the transmission of ultraviolet rays. In addition, this manufacturer suggests that after 2 months' exposure the amount of ultraviolet transmission through the acrylic sheet drops 50 percent and that passage of air or moisture around the acrylic sheet also tends to reduce the amount of ultraviolet transmitted. Another manufacturer reports that his company has already developed a methyl methacrylate sheet which incorporates an ingredient to screen out the ultraviolet rays, and that this has already been tested for light exposure. However, it has not yet been possible to screen out the infrared rays without introducing something which will discolor the transparent plastic sheet.*

[1] Data from Coblenz, Stair and Hogue, J. of Res., Bur. of Standards, 8, 546, 1932.
[2] Data supplied by an independent commercial testing laboratory.

Laminated plastics from paper

by WM. B. DARLING[1]

FOR some years table tops, radio panels, switchboard panels and similar items have been made from paper-base laminated plastics. The natural qualities of paper gave excellent insulation, water-, acid- and oil-resistance, and a high finish, but extensive use of these materials was curtailed by their lack of strength. To overcome this, a great deal of experimental work was undertaken and largely as a result of the researches conducted by the Forest Products Laboratory of the U. S. Department of Agriculture, a laminated plastics concern and a prominent aircraft manufacturer, a plastic material of paper base was developed for aircraft construction. This material showed a cross section tensile strength of up to 35,000 p.s.i. regularly, parallel grain laminated; and of up to 28,000 p.s.i., cross grain laminated. Modulus of elasticity averages from 2,500,000 to 3,000,000 p.s.i. Specific gravity ranges from 1.3 to 1.4. The weight-strength factor is equal to that of aluminum. Intricate shapes may be formed and the material lends itself to monocoque construction. Tubes and pipes of high strength are replacing metals in many instances.

There are four general requisites for the manufacture of the material. The first is the selection of a proper paper; the second, the choice of the right resin, taking into consideration the characteristics desired in the finished product. The proper amount of resin must then be determined for treatment of the paper, the volatiles content depending mostly on the process to be used in forming, pressures and temperatures. The fourth requisite calls for the paper to be laminated to the thickness desired and formed under heat and pressure until cured. In connection with this last phase, resin and paper manufacturers have gradually lowered their pressure limits to 250 p.s.i. as compared to the 1000 to 3000 p.s.i. formerly used, with temperatures maintained at about 300° F., thus opening up the field to laminating equipment which previously could not be used. Lowered pressure also permits the use of low-cost molds.

Paper combined with wood veneers has proved advantageous in some cases, but this should not be confused with the use of glue-film in veneer forming.

Applications of this development seem to be limited only by the fabricating equipment available and knowledge of the subject. There are presses able to form panels as large as 10 ft. by 12 ft., although most presses are much smaller. The finished material can easily be sawed, drilled or machined, and consequently flat panels have many applications, while the possibilities for molding formed articles are even greater. Using the autoclave process, the field is almost unlimited. For example, the Boeing B-24D is said to contain nearly 1500 parts of laminated plastics. Entire wing tips of planes are now made from paper-base material.[2]

[1] Riegel Paper Corporation.
[2] See MODERN PLASTICS 20, 82 (December 1942).

Finishing fixtures

(Continued from page 73)

6. White wheel polish.
7. Remove and set up new part.

The machine worked and demonstrated the methods used at the individual stations, but the means of changing from station to station were too crude. Came the war and toaster bases went overboard along with many other civilian parts. We were not sorry to see the wooden table go out.

We have finally settled down to certain standard methods and machine parts. The operations may be the removal of flash from a regular or irregular surface; drilling top, bottom or side holes; polishing top, side or edge. These, plus a multiple drill fixture that can be adjusted easily for different centers from a master plate that goes with the individual job, are the principal accomplishments of the new department to date. New work-bench layouts, tables for drill presses, bench lathes and the like plus a flow line rearrangement of the entire finishing department are all incidental to the day's work.

One problem we solved by the purchase of a machine outright—a comparometer shown in Figs. 1 and 2. The problem was a small disk, .018 in. to .022 in. thick, $1^1/_4$ in. diameter, that had to be flat within close limits. Ordinary inspection was indefinite and slow. It looked as if the inspection were going to cost more than we got for the piece. The final outcome was a fast, accurate inspection that definitely showed the parts good or bad beyond question. Thickness and wobble were picked up at a glance.

Another (shown in Fig. 4) was an intermittent chamfer on a closed end cylinder. The mold was completed before it was decided to have that particular design. Two opposite sectors of the edge had to be chamfered about $^3/_{32}$ in., and in between each the chamfer had to be raised to $^1/_{64}$ in. and blended back. A two-head spindle was modified to do this and actually proved cheaper in construction and operation than it would have been to incorporate the shape in the original mold with its land surface shifting from one plane to another. The operation is so fast that the operator just about has time to clamp one down, touch another on a small sanding wheel to remove a bottom flash, and set it on the opposite head.

The third (Fig. 3) was a sprue cutting machine for thermoplastic pendants. Six pendants are molded in a row on one side of the longitudinal gate and six beads on the other side. The beads have a knock-out tab on the side away from the sprue to take them over a pin that makes a small hole through the far end.

A chain machine was made with two wooden platforms shaped to carry the sprue as it came from the machine. Clamps hold the sprue down during the cutting operation. Three saws spaced diagonally, so that only one operates on each piece at a time, separate the body, bead and tab as the carriage moves forward. Later the sprue slides down one chute to the operator so he can return it to the injection machine, the bodies slide off to one box and the beads to another as the clamps are automatically released. The belt stops automatically when the operation is completed. The second carriage is then ready for the operator to set up the next sprue, and the operation is repeated when the operator touches a start button. The operation can be stopped at any point by pressing an emergency button. The saws operate only while the carriage is moving.

Out of all this has come a series of standard machines for standard operations, a small, not too complete, tool room for experimental work, and a wealth of ideas for new methods of doing things previously done by hand with a minimum of tool set-up changes. Grinding and the use of diamond tools seem to be the only answers to quantity machining of plastics, and sawing for thermoplastics.

4—Finishing machine removes fin and grinds bevel at the same time. It incorporates hoses which suck up the dust so that the operator isn't obliged to wear a mask

4

Snake bite kit

(Continued from page 75) possible—that is, in the position opposite to that shown on the drawing. The proper size of clear plastic cup is selected and pressed on the lower portion of the pump body; the opening "F" in this cup is then placed firmly on the portion of the body which has been bitten. The plunger is pulled to the raised position (as shown in drawing), which pulls a vacuum in the entire unit. However, when the pressure is released from the plunger, piston "D" drops and seals the vacuum at the valve seat "B," thereby holding whatever vacuum has been created in the lower portion of the unit. The vacuum then proceeds to withdraw the venom from the wound.

The plunger handle was molded first without the brass insert. The insert was then assembled into the top and spun over at that point, but it was found that the top became loose because the pumps are used as long as thirty hours continuously. By knurling the top portion of this rod and molding it in as an insert, this was overcome.

While the complete shot of the pump parts creates a relatively small shot in weight, a most unusual die design was necessary, due to the absolute dimensions involved and the fact that there were internal threads, external threads, a metal insert as well as vertical and horizontal core pulls—all in this one combination mold.

As this unit is to be used entirely in tropical climates, the molder used cellulose acetate butyrate in order to gain the greatest possible dimensional stability under humid conditions. The pump is very ingenious mechanically, as it will

4—*Pump is poised ready to extract venom from wound*

maintain a constant suction without continual pumping. The test required of it specified that it lift a 4-lb. weight by the vacuum created and suspend the weight for a period of time without actuating the plunger. A series of check valves allow plunger to be depressed without losing vacuum.

There is furnished with this kit a small knife which is inserted in a plastic holder with a press fit, and the whole, in turn, slides into the molded lance case. This case is reversible so that it can serve as a handle when inserted on the other end of the lance holder.

Credits—Material; Tenite II. Molded by Worcester Moulded Plastics Co. for Saunders Venom Extractor Co.

Treads and wheels for trucks

(*Continued from page 72*) been removed from the mold. These ball bearing races may be assembled into the hot wheel with a slight finger pressure; but when the wheels have cooled down to room temperature they will have shrunk tight onto the outside wall of the race, thus making a permanent assembly.

These phenolic treads and solid wheels have solved a highly critical supply problem without requiring any design changes in this company's equipment or any changes in their assembly technique. While rubber is still available for most of the wheeled stretchers, linen trucks and food service equipment which the company produces for hospital use, a replacement had to be found for its restaurant and industrial equipment. Even though most of its production in these lines is going to war plants or directly to the armed services, the one factor which may dictate a return to solid rubber tires once rubber is again available is the cost. The present tires molded from both general purpose and high impact phenolic material are substantially more expensive. However, if the new treads prove to be as long-lived in service as the preliminary tests indicate, the added cost may be justified on many types of this company's equipment, whatever the availability of rubber.

Credits—Material: Resinox. Molded by C. F. Church Mfg. Co. and Plastimold, Inc., for Jarvis and Jarvis, Inc

Plastic-plywood in aircraft

(*Continued from page 86*) panels of the XBT-16 airplane are of two-spar skin-stressed construction. While the basic structural type is conventional, the execution of the detailed construction features sets the structure apart from the conventional category. The wing outer-panel section with the front portion of the molded nose skin is shown in Fig. 9.

The outer-panel-wing front spar and I-section is constructed of birch plywood web and laminated hickory flange material. Spruce flanges molded to a Z-section form the outer-panel rear spar. Ribs are attached to the spar webs by standard plywood angles. Apron strips and molded skins themselves complete the tie-in structure for the rib to spar connections. The intermediate ribs are the thrust type, and the nose ribs are the web type.

Wing tips. Removable wing tips are constructed of birch plywood skin with spruce stringers, laminated spruce bow, and birch and poplar plywood reinforcements. The skins are molded in halves integral with the stringers and half of the bow end with birch reinforcing pad through which the attachment strip bolts pass. Cold glue operations are used to assemble the two wing tip halves and to secure a few small gussets (Figs. 10–11).

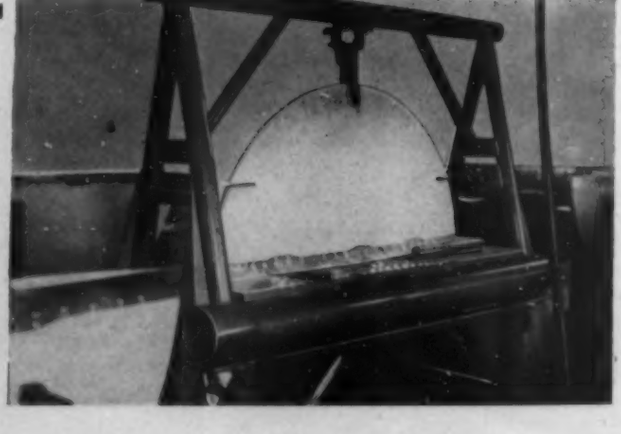
Acknowledgment

The writer wishes to express his gratitude to the War Department for permission to present some of the information about the XBT-16. Appreciation for collaboration is expressed to the management and to the Engineering Department staff of Universal Moulded Products Corporation.

10—*Half wing tip mandrel, routed and fitted with stringers and attachment pad.* **11**—*Complete wing tip in jig*

10

11



Keyboard for color

(Continued from page 58)

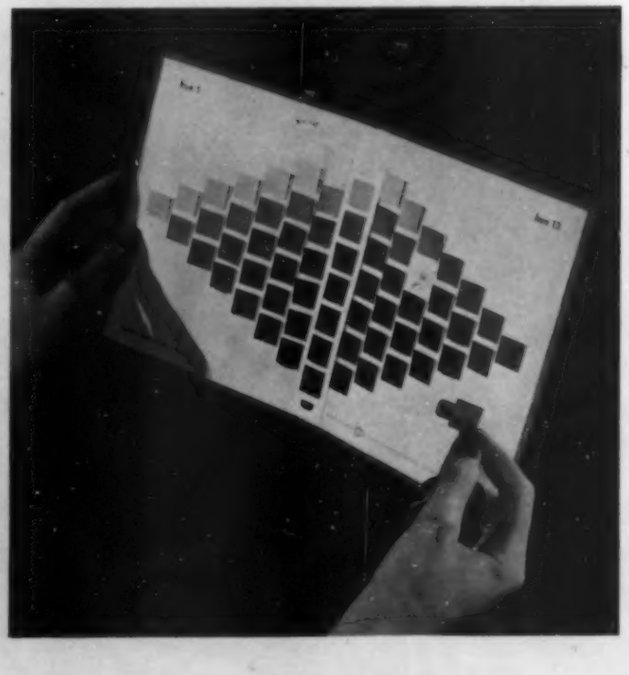
The problem, then, is to relate the chromatic to the achromatic colors in such a way that we may find relationships that will guide us in our search for harmony. At point C, equidistant from *W* and *B*, we place any color of the hue circle, Fig. 3. Let us say *C* is pure yellow; then all the tints between pure yellow and white must occur on the line *CW*. All the tones between pure yellow and black must occur on the line *CB;* and all the combinations between pure yellow and the grays on *WB* will be found within the triangle.

After much experiment, Ostwald found that 24 hues were enough to have in a practical hue circle. He therefore made a triangle like Fig. 3 (called monochromatic) for each of the 24 hues, and arranged them to meet on their common side *WB*, Fig. 4. He called this the color solid. In it there are 672 chromatic colors plus the achromatic scale of 8 colors.

We can, of course, distinguish between many more than 680 colors, but if we had all the possible colors in the color solid, they would blend imperceptibly into each other so that we could find no points of reference. Twenty-four monochromatic triangles each with 28 colors, provide enough colors for everyday use because they are so measured as to appear at perceptually equal intervals with respect to their hue, white and black content. It is this measured regularity of interval which makes possible the discovery of harmonious relationships, just as the measured sound frequencies of the tuned piano assure regular tone intervals on the keyboard. Moreover, each color is known by a simple alphabetical and numerical notation, symbolizing hue and white or black content. Thus every color, like every musical tone, has its place and its symbol in an established order.

This is not the place to describe the Ostwald principles in more detail; a text accompanying the Color Harmony Index does that, and they are completely understood only when the actual colors are within view. The point is that the logic and orderliness of the arrangement made it a comparatively simple matter to find a mechanical method for presenting it. It was only necessary to provide one flexible enough to

7—One of the 12 book charts of the color harmony manual



accommodate the required number of elements and one that would make them easily and quickly available.

The Autodex,[1] manufactured by Zephyr American Co., almost exactly suited the purpose. One Autodex could not hold enough cards on which to fasten 672 one-inch square swatches, but six of them mounted on a wooden base do the job nicely. Because six indexes in a row would be rather bulky to handle, the base is cut in two equal parts and hinged to fold back on itself. The original Autodex was also too shallow to admit the required number of cards, 14 in each compartment. Hence each Autodex back was sawed out (with some difficulty) and the wooden base serves in its place. It remained only to apply the color notation to the index covers. Instead of preparing a special steel die, which couldn't be had because of the shortage, it was decided to apply the letters and numbers by silk screen printing.

As for the color chips, they were prepared by applying a pigmented film of appropriate color to a base of clear, transparent cellulose acetate. Thus a color standard with a dull surface on the side of the coating and a glossy surface on the other side is provided. This feature facilitates the comparison of flat colors with ink or wet paint samples. Pigments of maximum permanence were used in a vehicle composed of cellulose acetate to keep color change with age at a minimum. These were sprayed on sheets 5 by 8 in., and then die-cut. There are 8 color chips inserted in each of 84 celluloid cards $2^1/_2$ in. by 4 inches.

The colors in the Index were developed by Carl E. Foss from colorimetric specifications in accordance with standard procedures through the use of spectrophotometric measurements. Almost two years of rigorous laboratory work are represented in this project. For the plastics industry, as for any other in which color is important, the Index provides a precision instrument for everyday use.

[1] See MODERN PLASTICS *18*, 102 (October 1940).

Protecting textiles

(*Continued from page 53*) removed, was equally as unattractive as the all rayon with no finish. The silverfish apparently are not interested in unfinished fabric.

Sample No. 8, all cotton treated with Cooper's gelatin, was likewise unattractive. Cooper's gelatin is a sclero-protein. Although casein is also a protein, it is a phospho-protein, an entirely different type from the sclero-protein. It appears that silverfish find the phosphorus-containing protein inviting but reject the sclero-protein.

These results indicate that silverfish will not eat unfinished goods or goods with the finish removed. They particularly are attracted to starch finishes but will feed where casein is present. Although it is commonly said that silverfish will eat protein, in a general sense they were not attracted to the sclero-protein in the Cooper's gelatin.

Unfinished goods are ordinarily unattractive to the consumer who likes to have them crisp, fresh looking, and having the appearance of being freshly laundered. Starch finishes are invitations to silverfish for a raid which ends in destruction of the fabric. Urea-formaldehyde resins properly applied serve as a protection against silverfish damages, while at the same time giving the desired finished characteristics in the article.

Army astro domes

(*Continued from page 56*) A second girl inspector revolves the dome through all the vertical positions. No dome is considered acceptable if the transit cross hairs appear displaced more than six-tenths of an inch from the target when the dome is in any of the critical sighting positions. In addition, acceptable domes can be calibrated throughout their critical area to an accuracy of plus or minus one-tenth of an inch displacement at fifty feet. This corresponds to a possible navigation accuracy of less than 1 (figure 1) terrestrial mile.

Despite the high optical specifications these domes must meet, thousands are being turned out each month—enough so that every American-made bomber can benefit from the precision navigation which is so necessary to the precision bombing of our airmen on all the world's battlefronts.

Credit—Material: Plexiglas

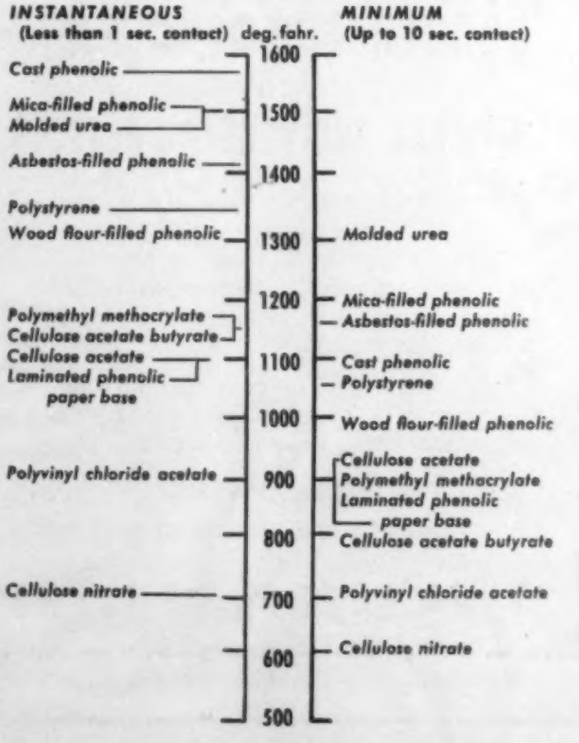
Ignition points of plastics

(*Continued from page 88*)

6. Cellulose acetate butyrate, CO-16049, H-3, amber, $^1/_{16}$ in. thick, Tennessee Eastman Corp.
7. Laminated phenolic, paper base, grade XX, $^1/_{16}$ in. thick, Synthane Corp.
8. Cast phenol-formaldehyde resin, $^1/_8$ in. thick, Catalin Corp.
9. Woodflour-filled molded phenolic, Resinox No. 2043, blue, $^1/_{16}$ in. thick, Monsanto Chemical Co.
10. Mica-filled molded phenolic, Durez No. 237, $^1/_{16}$ in. thick, Durez Plastics & Chemicals, Inc.
11. Asbestos-filled molded phenolic, Bakelite BM 8041, black, $^1/_{16}$ in, thick, Bakelite Corp.

(*Please turn to page 124*)

2 **IGNITION POINTS OF PLASTICS**



12. Molded urea-formaldehyde, Plaskon Blue 892, 1/16 in. thick, Plaskon Co., Inc.

Materials Nos. 9, 10 and 11 were molded at 360° F., under 3000 p.s.i. pressure for 5 min., while material No. 12 was molded at 315° F., under 3000 p.s.i. pressure for 6 minutes.

Results

Determination of the ignition point of plastic materials was based upon two considerations:

a) The minimum temperature at which the plastic would spontaneously burst into flame upon contact with molten sodium hydroxide, and

b) The time required for the action of bursting into flame to occur.

The results of the tests are shown in Fig. 2. The chart consists of two sets of figures: one, the minimum temperature ±25° F. at which ignition is first observed—at this temperature the plastic may be held in contact with the molten salt as long as ten seconds; and second, the temperature at which instantaneous ignition (less than one second) is observed. The variation between the two temperatures may be as much as 200° F., as noted in Fig. 2. It is the feeling of the authors that ignition temperature is best reported as the lowest temperature at which a plastic material will burst into flames.

It will be observed that there is some temperature at which each plastic will burst into flames, irrespective of the filler employed. The minimum temperature at which ignition is first observed is quite well defined, because no matter how long a plastic material may be held in contact with the fused mass at a lower temperature, say, 25° F., below the ignition point, it will not burst into flames.

As to the phenomena which occur below the ignition point, much depends on the chemical identity of the plastics. Softening, rapid evolution of gases and smoke, carbonization, etc., are usually manifested.

In general, thermosetting materials have higher ignition points than thermoplastic materials.

Postwar motor car

(*Continued from page 50*) The joining boards are filled and the outer surface coated with de luxe resin clear.

The entire framework of the body is made of steel tubing bent to shape and welded to the chassis. The front seat is wide enough to carry four passengers in comfort, and there is room in back for a half-dozen more—all this on a conventional Chevrolet chassis. Shatterproof glass is used throughout, and a novel vee windshield allows ventilation at the top edge. Flaps at the top of the windshield provide an exceptional amount of fresh air for summer driving.

The body is full width, the four wheels being enclosed with hinged sections which allow for tire changing. The entire car weighs only 2500 lb., a saving of 600 lb. on the body alone.

In mass production, such a body would be formed and bonded in one operation with a phenolic resin, in a closed chamber, using a vacuum on the under side next to the wood or concrete car-shaped mandrel, while a flexible blanket would be placed over the double-laminated wood. A round top oven would enclose the upper half, into which compressed air would be forced to press the wood against the mandrel. Either electric heaters or induction would bond the lamination into a permanent, waterproof shape.

As an artist, Russell prefers the clear finish, revealing the natural wood grain. He suggests that by use of a thin top veneer of mahogany or any of the rare woods, some striking

effects could be achieved. There is no reason, however, why the body could not be finished, over its waterproof resin coating, with any of the opaque colors now used on cars, making it indistinguishable from steel.

A plastic automobile body designed by Russell, which attracted much attention a year ago, was formed of ethyl cellulose thrown on wire screening. He has not given up his research in this field, but he points out that the plywood body appears to have certain advantages:

1) It is much less expensive, particularly if it can be formed without compound curves, avoiding costly heat-setting processes.

2) It compares favorably with steel when placed under impact and stress tests.

3) It is lighter than all-plastic and much lighter than steel. Virtually the only steel in the car is in the bumper strips.

Heating phenolics

(*Continued from page 82*) temperatures than do the inorganic- or mineral-filled materials.

The limits for the organic-filled compositions are only slightly below those previously reported by the authors[1] for short-time temperature effects. On the other hand, they are well above the limits established by the Army and Navy for molded parts for military applications, which require that the piece be serviceable at temperatures up to 70° C. (160° F.). The materials can in fact be used in structural applications where heat from engines and sources other than normal atmospheric conditions will elevate the temperature up to the limits reported.

The limits on the mica-filled and especially the asbestos-filled materials at 200°–220° C. (392°–428° F.) are sufficiently high to indicate their use for numerous applications where very high temperatures are likely to prevail for extended times. While the impact strengths of these products are such that they may be considered only as semi-structural materials, they can be used where resistance to elevated temperatures is the prevailing factor.

In work of an empirical nature, such as is discussed here, it must be remembered that the results obtained are based on standard A.S.T.M. methods, and the actual numerical values serve principally as a comparative basis for evaluating specific mechanical properties. Such other factors as molding conditions, form factors, combined stresses in application and many others have a marked influence on the serviceability of the molded article. The final evaluation must, therefore, be based on actual service tests of the product.

Acknowledgment: The writers are indebted to R. A. Klucken, who conducted the laboratory tests upon which the data and discussions presented here are based.

TABLE XI.—APPROXIMATE LIMITING TEMPERATURES FOR PHENOLIC PLASTICS ON BASIS OF 10 PERCENT REDUCTION IN STRENGTH AFTER 162 HOURS' HEATING

Material tested	*Flexure*		*Impact*	
	°C.	*°F.*	*°C.*	*°F.*
Pure phenolic resin	140	284	140	284
Woodflour-filled phenolic	170	338	150	302
Fabric-filled phenolic	150	302	130	266
Cord-filled phenolic	130	266	130	266
Mica-filled phenolic	200	392	200	392
Asbestos-filled phenolic	220	428	220	428

Mopping up

(*Continued from page 59*)

The manufacturer of these mops doubts very much that he will ever go back to steel frames even when the end of the war makes metal again available. The light weight of the cellulose acetate butyrate renders the new frame from one-half to one-third as heavy as frames of steel—an item which, he has found, is appreciated by mop-pushers everywhere. The flexibility of the plastic frames makes it easy to remove pads for washing and, since the butyrate is dimensionally stable, frames won't warp out of shape. Rough usage at the hands of the inexperienced duster-up won't injure them, and they can't assume the dingy, rusty appearance so often characteristic of hard-working cleaning appliances. The color appeal of the plastic frames has also been an important factor in merchandising the new mops.

Credits—Material: Tenite II. Molded in Canada by Percy Hermant, Ltd., and Ontario Steel Products Co., Plastics Div., and in the U. S. by Detroit Macoid Corp., for O-Cedar of Canada, Ltd.

Molded gas mask parts

(*Continued from page 67*) so designed that acetone from the pin sometimes splashed onto the sealing surface of the valve during the assembly operation. In order to eliminate this difficulty and protect the seat of the valve from sprayed acetone, a movable sleeve was inserted inside the assembly cup. This sleeve now acts as a shield for the seat of the valve and at the same time in no way affects the actual assembly operation.

Figure 9 shows the complete set-up for the assembly operations—gaging, inspection and packing—on the valve part of the unit. It can be seen that at one end of a moving belt there are several pin assembly stations. The pin having been assembled, the unit is placed on a moving belt and proceeds to the inspection and gaging stations. At this point both visual and dimensional inspections occur. Very accurate steel gages are used to gage the important .180-in. to .190-in. dimension, after which a careful visual inspection rejects any poorly molded parts. The final station on the moving belt is the packing station. At this point, the valve and pin assembly is carefully packed in nested cartons for shipment to the various gas mask assembly plants.

Inasmuch as the only finishing operation on the guard is the one of gate removal, there is no reason for a moving belt unit for this part. The gates are merely clipped with a unique pair of clippers before parts are packed.

This molder has planned and developed all of the ingenious devices which have been described above, even though he was pressed for time on delivery. The superb production record he has made is proof positive of the fact that every new molding job should be carefully engineered, not only from the standpoint of mold design, but also from the standpoint of the finishing, assembly and inspection.

After all the integral parts for the civilian gas mask have been manufactured in various parts of the country, they are shipped to the final assembly plant. The plastic outlet valve is here equipped with its highly important rubber sealing valve. This is a hand assembly operation and is shown in Fig. 11. Inasmuch as the fit of the sealing surface of this rubber valve to the sealing surface of the plastic valve means the difference between life and death to the wearer, it is highly important that any trace of leakage be discovered. Figure 10

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shows the testing equipment which is used for the 100 percent careful inspection of this sealing. If this equipment indicates any leakage, the unit is promptly rejected.

Figure 12 shows the first hand operation in the assembly of the outlet valve to the facepiece. In this operation the ferrule is forced through a hole in the side of the facepiece. It is then put on a moving belt and carried to the final assembly station, at which point the previously described speed nut is assembled. In order to complete this assembly the valve is placed in a foot press (Fig. 13) and a round guide pin is inserted into the collar of the ferrule. A speed nut is then placed over the guide pin and the upper tool snaps the speed nut over the collar of the ferrule, allowing the speed nut prongs to set against the underside of this collar. This causes the speed nut to press the rubber facepiece firmly against the underside of the plastic outlet valve for a perfect seal. Figure 14 shows the facepiece turned inside out so that this completed assembly may be seen. This assembly is also carefully checked for any possible leakage, as shown in Fig. 15.

The parts having passed this careful test for leakage, the assembly of the guard into the valve is the next operation. The guard is screwed into the valve, and a drop of acetone placed in the threads securely locks the two parts together.

In the assembly of the canister, a strip of adhesive tape is first wrapped around the top edge of the canister. This top edge is then inserted in a large hole in the front of the facepiece to a depth of approximately $^5/_8$ inch. The previously described clamp is then placed around the facepiece where it engages the canister and is latched to the first stop. This is sufficient to hold the assembly together while the canister is being placed in a cradle in a foot press (see Fig. 17). Note how a lip is formed at two locations of the clamps to provide a place for the foot press tools to grip as the clamp is tightened. After the canister is placed in position in the foot press, the operator presses the foot lever, causing the tools to close the clamp tighter. As the clamp closes, the latching finger "ratchets" through the sawtooth prongs and finally locks into the proper pair of prongs for a tight grip and a perfect seal (Fig. 18).

Inasmuch as the facepiece arrives at the assembly plant complete with plastic lenses and harness, this final operation completes the civilian gas mask.

Credits—Material: Tenite II, Lumarith X.

Plastic punches

(*Continued from page 69*) Thus the plastic punch saves press set-up time. Normal production difficulties are obviously encountered: for example, it was difficult to form a number of parallel beads located in the bottom of a certain part. Good beads were obtained by increasing pressure.

The following is a comparison of the forming of the same part when the two methods were applied in making punches:

Kirksite punch	*Plastic punch*
Make templates	Pour directly to die
Make plaster pattern	Clear for metal thickness where necessary (time: $3^1/_2$ hr.)
Cast punch in sand, using mold taken from plaster	Rout (trim)
Grind in punch to fit die, less metal thickness (time: 5 days)	
Run parts	
Anneal	
Hit on drop hammer	
Rout (trim)	

(*Please turn to page 132*)

Casting plastic punches

Ordinary wood sides are built up around the die and the inside wood surfaces are lined with tin. Fillets are made with molder's clay. Sides usually extend about 10 in. above top of die, resulting in a thicker punch than is usual in lead. Impact is better absorbed and transmitted when the plastic punch is about 25 percent greater than the lead punch in thickness.

To facilitate melting or preparation for casting, two distinct thermoplastic materials with different melting points are combined to form the final casting compound for punches. The material with the lower melting point is first melted to start a batch, and when a liquid state is reached, the second material is slowly added. The mixture is agitated from the start, and constantly during the "cook" to prevent burning. Reclaimed pieces may be added while the mixture is being melted. Since the plastic is 100 percent reclaimable, used or broken punches may be broken up and remelted as indicated above. To attempt to remelt chunks directly often results in burning them before they have reached a state of fusion, hence remelt material should be added to a batch of new liquid. The mixture is heated to and maintained about 45 min. at a temperature of 205° C. (401° F.), at which time the heating agent is cut off and the mix allowed to cool to 175° C. (347° F.), being agitated continuously.

While at this temperature the melt is cast into the Kirksite die, being poured through a special funnel, the lower end of which is kept below the surface of the plastic in the die to avoid lapping of the material, which tends to cause weakened planes, and trapping of air. Immediately after the punch is poured, the inserts, located by means of studs to a spider, are lowered into the punch to a predetermined depth. The top of the insert preferably should not lie more than 1 in. below the surface of the finished punch. Precautions that will insure normal and properly located inserts and reduce possibility of breaking the punch in use are a level die, accurate spider parallel to die, and holes for studs through spider to offer sliding fit yet hold studs close to 90°.

The material is made to shrink from the top of the punch down as it cools by means of standard cabinetmaker's clamps which apply pressure to a wood plate placed on top of the punch after first covering it with metal. The material is thereby prevented from shrinking away from the die and is forced into perfect conformity with it.

Although the total time required to prepare, cast and cool a plastic punch is more than that required for one of lead, when operations permit having a pot of the thermoplastic continuously ready to cast, the over-all time will be reduced about one-half, for it requires around 6 hours to cook.

The punch, whose top surface is not ordinarily smooth or parallel to the base of the die, is left in place in the die, after forms and clamps have been removed, and is surfaced parallel to its base on a planer or similar machine.

The thermoplastic casting material may be cut or worked with any kind of cutting tool and, not being abrasive, does not dull tools. Being a thermoplastic, it cannot be ground or sanded, and tends to gum up tools like circular and band saws that generate heat rapidly. However, it may be drilled, tapped, planed or worked with hand woodworking tools. It is easy to handle, for it weighs but 68 lb. to a cubic foot.

Under proper conditions and within certain bounds of application, the plastic material produces better and more uniform parts, and does it faster than other materials.

Credit—Material: Plastalloy.

Wartime conference

(*Continued from page 62*) he said, "but they do have a definite place in the armament program and can be of the greatest benefit in securing victory and peace if they are applied with consideration of the molded parts' combat efficiency and the material properties necessary to meet Ordnance requirements."

Dr. W. Gallay, National Research Council, Ottawa, asked for creation of a Technical Committee on plastics to further war production. Dr. Gallay emphasized the comparative dearth of information on physical properties of the various plastics. He advocated the creation of an inter-departmental committee to coordinate and develop plastics uses. This Committee, under Dr. Gallay's plan, would cooperate with the operative branches of Government, such as the procurement agencies of the armed forces, and help guide them in proper selection of materials, and in adopting a technique for handling particular problems.

C. B. Stenning of the Conservation Committee, Department of Munitions and Supply, explained the conservation set-up of the Government, and said that he had been asked to fill in a plan for conservation in the plastics industry comparable to the job that was being done in other industries. He told of some of the difficulties in such a task and pledged his cooperation toward effecting a helpful program, while at the same time seeking cooperation from the industry in devising and fostering conservation plans.

James H. Savage, Plastics Consultant, Conservation Division, War Production Board, U. S. Government, outlined briefly what the conservation program in the United States was intended to accomplish in so far as it affected plastics. He told how substituting to relieve a shortage frequently produces a shortage, and said that was exactly what had happened in plastics. For this reason, Mr. Savage drove home the point that plastics can no longer be considered a substitute material.

"When the question of which material is to be used in a certain application comes to us, we must think in terms of which material will best perform the function. Plastics are now preferred materials, the supply of which is insufficient for anything but essential war use . . . . Let us not waste these precious materials," Mr. Savage concluded, "by permitting them to become 'substitutes' when they have their own important, and sometimes vital, jobs to do. Effective conservation is essential so that we may reap the most widespread benefits from our limited supply of plastics—civilization's new 'supermaterial.' "

Methods and practices of molding laminated structures and resin-impregnated material were brought out in a speech by Dr. L. J. Marhoefer, Chief Engineer, Vidal Research Corporation. Dr. Marhoefer traced the history of low pressure fluid molding and discussed methods and new materials in some detail. He also took up the potentiality of new uses for structural laminates, and indicated where they stand at present in the development stage. For example, he indicated that the present fabric materials have shown too low a modulus of elasticity for use in structural parts.

William Dial, Columbia Chemical Division of Pittsburgh Plate Glass Co., traced the development of the various Columbia resins and discussed particularly C.R.39. Mr. Dial said that the development of the various Columbia resins was based on the premise that there should be a place in the plastics field for a clear, transparent resin having high abrasion resistance, low heat distortion, resistance to organic and inorganic solvents and resistance to crazing.

"It was thought in our group," he continued, "that these factors pointed to thermosetting rather than thermoplastic resins."

Emphasizing the machinability of C.R.39, the speaker said that sawing, sanding, buffing and grinding may be done at high speeds without coolants with no tendency of the material to drag, fuse or gum. (*Please turn to page 136*)

Although C.R.39 is referred to as being thermosetting, sheets become formable when heated to elevated temperatures. However, deep draws over large areas cannot yet be produced.

Mr. Dial forecast new possibilities for using the resin in the laminating field, since monomeric C.R.39 will cure without the release of volatile by-products; and because of its low viscosity and high penetrating power, will eliminate the need for solvents in the impregnating process. Lamination can be accomplished with C.R.39 monomer at a minimum pressure of 15 p.s.i. and usually below 5 p.s.i., thus eliminating need for large, steam-heated hydraulic presses. He described various methods of applying pressure and revealed that one of the most satisfactory is the vacuum bag process. However, he concluded, while lower pressures and curing temperatures may be used, longer curing cycles are needed.

Vinyl chloride-acetate copolymer, which is a conjoint polymer of vinyl chloride and vinyl acetate, was discussed by J. D. Benedito, sales manager of Canadian Resins & Chemicals, Ltd.

Mr. Benedito revealed that this resin has become so important that a new plant for its manufacture will be completed soon, and it will probably be made available to Canadian industry sometime in the spring.

The adoption of vinyl coatings as standard insulation aboard U. S. Navy vessels was discussed by the speaker, and he emphasized that their use represented a distinct improvement over materials formerly used by the Navy. He predicted a widespread increase in the use of the material in the postwar period because of an almost certain increase in the use of electricity and electrical appliances.

Second in importance to its fine insulating properties, Mr. Benedito said, is the material's adaptability for proofing of fabrics. Through this method better raincoats and tents are made for Canadian and U. S. armed forces.

C. A. Norris, of the Bakelite Corp. outlined the origin of transfer molding and discussed its technique. He told how, early in 1926, The Shaw Insulator Co. was attempting to mold firing pins for the U. S. Navy. The piece consisted of a steel insert about $1^1/_4$ in. long to be encased in a shell of phenolic molding material. Attempts at molding by conventional compression methods worked out poorly and, Mr. Norris said, Mr. Shaw of the company then conceived the idea of placing the insert in the mold, closing the mold empty and then transferring the molding material in a plastic state into the cavities through openings or gates from an auxiliary pressure pot located above the mold proper. This, according to the speaker, was the birth of transfer molding.

Mr. Norris then traced the history of other jobs which were logical steps from the first successful transfer molding process. He gave examples of transfer molding with fabric-filled phenolics and said they had worked out very well.

Jet molding, as patented by C. D. Shaw and licensed by Plastics Processes, Inc., Cleveland, Ohio, was also discussed by Mr. Norris. He said that the basic difference between jet and transfer molding was in the method used to apply the heat necessary to polymerize the material. (See MODERN PLASTICS *20* (Nov. 1942.), p. 43 ff.)

Thus through the development of these processes, Mr. Norris concluded, jobs that were impractical heretofore, if not impossible, are now accomplished facts.

Ronald Kinnear, President of SPI, spoke at the closing banquet and gave a brief picture of the plastics industry's contribution to the war, and of its tremendous growth in the past 5 years. He predicted still more accomplishments by the industry and said it was gratifying to see such interest and cooperative spirit among the Canadian members of the industry.

William Cruse, executive vice-president of SPI, described the SPI's work, its cooperation with various agencies of the U. S. Government, and the activities of its various technical committees. He expressed pleasure at the size of the turnout by the industry at this, the first meeting of the Canadian Section, and pledged his help and cooperation.

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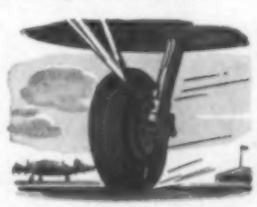

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